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SURVEY OF FISHERY RESOURCES IN THE MESHIK RIVER DRAINAGE, ALASKA

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SURVEY OF FISHERY RESOURCES

IN THE MESHIK RIVER DRAINAGE BASIN

by

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ABSTRACT

A fish resource inventory of the Meshik River drainage basin was conducted from 22 May to 4 September 1984 to provide baseline data on the physical, chemical and biological characteristics of the drainage. The Meshik River drainage is situated along a proposed pipeline corridor crossing the Alaska Peninsula from Port Heiden Bay to Kujulik Bay and is within the boundaries of the Alaska Peninsula National Wildlife Refuge (Refuge) (Anonymous 1985). Gill nets, minnow nets, fyke nets and hook and line were used to collect fish; aerial surveys were flown to identify salmonid spawning areas. Riverine habitat was observed during float trips and foot surveys of the river.

Species commonly found included: (1) adult and juvenile chinook (*Oncorhynchus tshawytscha*), coho (*O. kisutch*), sockeye (*O. nerka*) and chum (*O. keta*) salmon; (2) Dolly Varden (*Salvelinus malma*); (3) coastrange sculpin (*Cottus aleuticus*); (4) threespine (*Gasterosteus aculeatus*) and ninespine (*Pungitius pungitius*) stickleback. One Alaska blackfish (*Dallia pectoralis*), one starry flounder (*Platichthys stellatus*) and 11 pink salmon (*O. gorbuscha*) were captured.

Juvenile coho salmon and Dolly Varden had the furthest upstream distributions of all species. Salmonid spawning areas were located in the headwaters and in most second-order tributaries of the Meshik River. The upstream limits of chinook and coho salmon rearing areas appear to correspond closely to the upstream limits of their spawning areas.

Our results indicate that age 1 chinook salmon and age 1 and 2 coho salmon migrate out of the Meshik River by the end of June. Sockeye salmon generally leave the Meshik River system as age 1 fish, but the time of migration was not determined. Adult chinook salmon had spent one to five years in salt water,

coho salmon one year in salt water, chum salmon three to five years in salt water and sockeye two or three years in salt water. In 1984, chinook salmon were the first anadromous adults observed entering the Meshik River (early June), followed by chum and sockeye salmon (late June), Dolly Varden (early July), and coho salmon (late August).

The proposed pipeline corridor may affect spawning and rearing habitat as follows: 1) chinook salmon, 43 km and 168 km; 2) coho salmon, 56 km and 162 km; 3) sockeye salmon, 67 km and 166 km; and 4) chum salmon, 90 km and 199 km. An additional 168 km of tributary streams are known to contain adult fish and may provide additional spawning and rearing habitat.

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INTRODUCTION

A fish inventory of the Meshik River drainage was conducted from 22 May 1984 to 4 September 1984 to provide baseline data on the physical, chemical and biological characteristics of the drainage. The Meshik River drainage is situated along a proposed pipeline corridor crossing the Alaska Peninsula and is within the boundaries of the Alaska Peninsula National Wildlife Refuge (Refuge) (Anonymous 1985). Primary inventory objectives were: 1) determine fish species presence and distribution; 2) determine the timing of juvenile and adult salmonid seaward and spawning migrations; 3) identify the ages, average lengths and weights of juvenile anadromous salmonids and resident fishes; 4) identify the ages and average lengths of spawning salmon; 5) identify salmon spawning and rearing areas that may be affected by proposed oil pipeline and hard rock mineral transportation corridors; and 6) obtain descriptive data on the physical and hydrological characteristics of the Meshik River drainage.

This investigation was initially funded to provide baseline fishery information to aid in evaluation of potential impacts of a proposed oil pipeline. The proposed pipeline corridor was one of three transportation corridors identified in the preferred alternative of the Bristol Bay Regional Management Plan (Anonymous 1985). The proposed corridor in the Meshik River drainage would cross the Alaska Peninsula from Port Heiden on the Bristol Bay side to Kujulik Bay, Aniakchak Bay or Hook Bay on the Gulf of Alaska (Figure 1).

A proposed hard-rock mineral transportation corridor was identified when Anaconda Minerals Company received a special use permit on 5 July 1984 to conduct mineral exploration in the headwaters of Braided Creek, a tributary to the Meshik River. High grade mineral deposits consisting of lead, zinc,

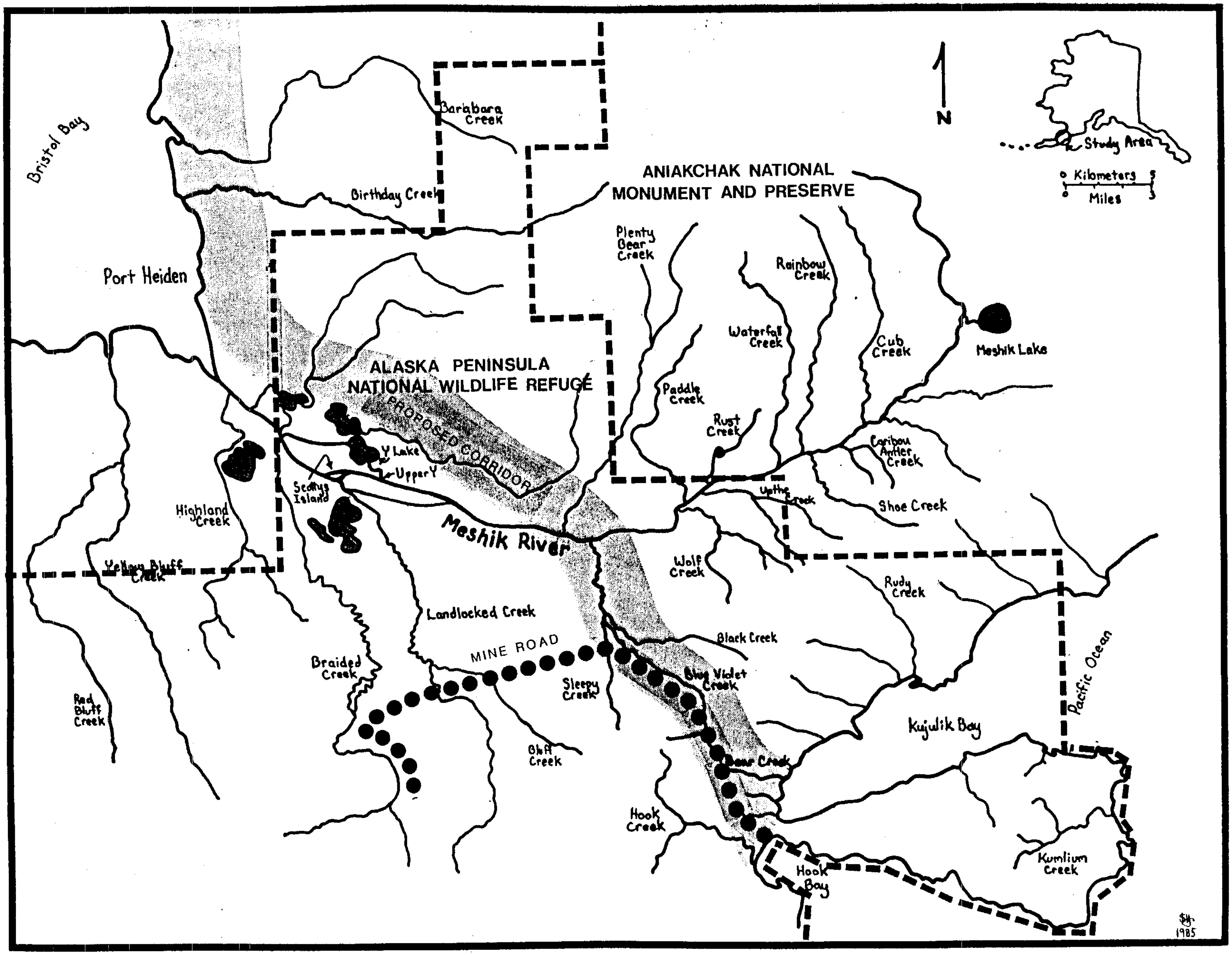


Figure 1.-Meshik River drainage basin and adjacent environment, showing the location of the proposed corridor (shaded band) and existing mine road (dotted line).

copper, silver and gold were found (C. Marrs, Anaconda Minerals Company, personal communication), and the Alaska Peninsula Refuge manager anticipated that the company will want to recover the mineral deposits (J. Taylor,Alaska Peninsula National Wildlife Refuge, personal communication). Reasonable access to the claims is guaranteed by the 1980 Alaska National Interest Lands Conservation Act (ANILCA) (Section 11:10, Section A).

It was also this study's intent to satisfy the mandates of habitat assessment by ANILCA for a basic inventory of fish distribution. Only limited aerial surveys of spawning areas by the Alaska Department of Fish and Game had been conducted on the Meshik River, and no ground based fishery investigation had been conducted.

Age, weight and length information for juvenile anadromous salmonids and resident fishes was collected to provide baseline information on the fish resource present in the Meshik River drainage. Migration timing and area use information was gathered to aid in future evaluations of stream crossings and construction timing. Water quality and physical descriptions are provided as background information to aid in evaluating potential development impacts.

Aquatic habitat descriptions from this inventory provide qualitative baseline information about the Meshik River drainage basin prior to development of proposed oil pipeline and hard rock mineral transportation corridors. Possible impacts to a fishery resulting from development of these corridors include increased sediment loads, dewatering of tributaries and increased human presence (Cederholm, et al. 1979; Hanley 1981). Potential impacts to the Meshik River fishery need to be anticipated and further studies conducted to be able to reduce, avoid, or mitigate possible negative impacts.

STUDY AREA

A literature search was conducted to obtain information about the general topography, soil types, and plant ecosystems of the Meshik River drainage basin. U.S. Geological Survey 1:63,360 scale maps were used to determine stream order (Strahler 1957) and gradient. Site-specific riverine habitat observations were collected during float trips and foot surveys of the river.

Average summer and winter temperatures at Port Heiden, located 16 km northwest of the mouth of the Meshik River, ranged from 4.4 - 15.0°C and -10.0 - 0.6°C respectively, average annual precipitation is 33 cm (includes 74 cm snow), and average yearly wind speed is SSE 23.1 kph (Selkregg 1976). Climatic conditions recorded at Scotty's Island during this inventory are listed in Table 1.

The Meshik River originates on the steep east-facing slopes of Aniakchak Peak and discharges into the Port Heiden estuary of Bristol Bay (Figure 1). Numerous small glacier-fed and mountain tributaries combine to form a fifth-order stream 82 km long. The Meshik River drainage basin of 523 km^2 can be separated into two distinct areas: 1) the main stem drainage, which comprises 85 km^2 of wet tundra adjacent to the main stem and 2) tributary drainages, which add 438 km^2. Most of the drainage basin is within the boundaries of the Alaska Peninsula Refuge and Aniakchak National Monument.

An unconsolidated mixture of gravel, sand, silt and clay underlies most of the Meshik River basin, with various forms of volcanic bedrock present in tributary headwaters (Selkregg 1976). Treeless lowlands surrounding the Meshik River are moist and wet tundra (Selkregg 1976), typical of the Alaska Peninsula (U.S. Fish and Wildlife Service 1985, Bristol Bay Coastal Resource Service Area Board 1984). The area surrounding the headwaters of the Meshik River and its

Table 1.-Mean monthly air temperature and precipitation (range in parentheses) at Scottys Island, Meshik River, Alaska during 1984.

	Mean air Temperature in °C		Mean precipitation in mm
	high	low	
June	17.7	7.2	0.006
	(12.2 - 21.6)	(2.2 - 14.4)	(0.0 - 0.038)
July	17.7	8.3	0.024
	(11.1 - 24.4)	(5.5 - 13.3)	(0.0 - 0.114)
August	18.8	11.1	0.019
	(11.1 - 27.7)	(6.6 - 18.3)	(0.0 - 0.135)

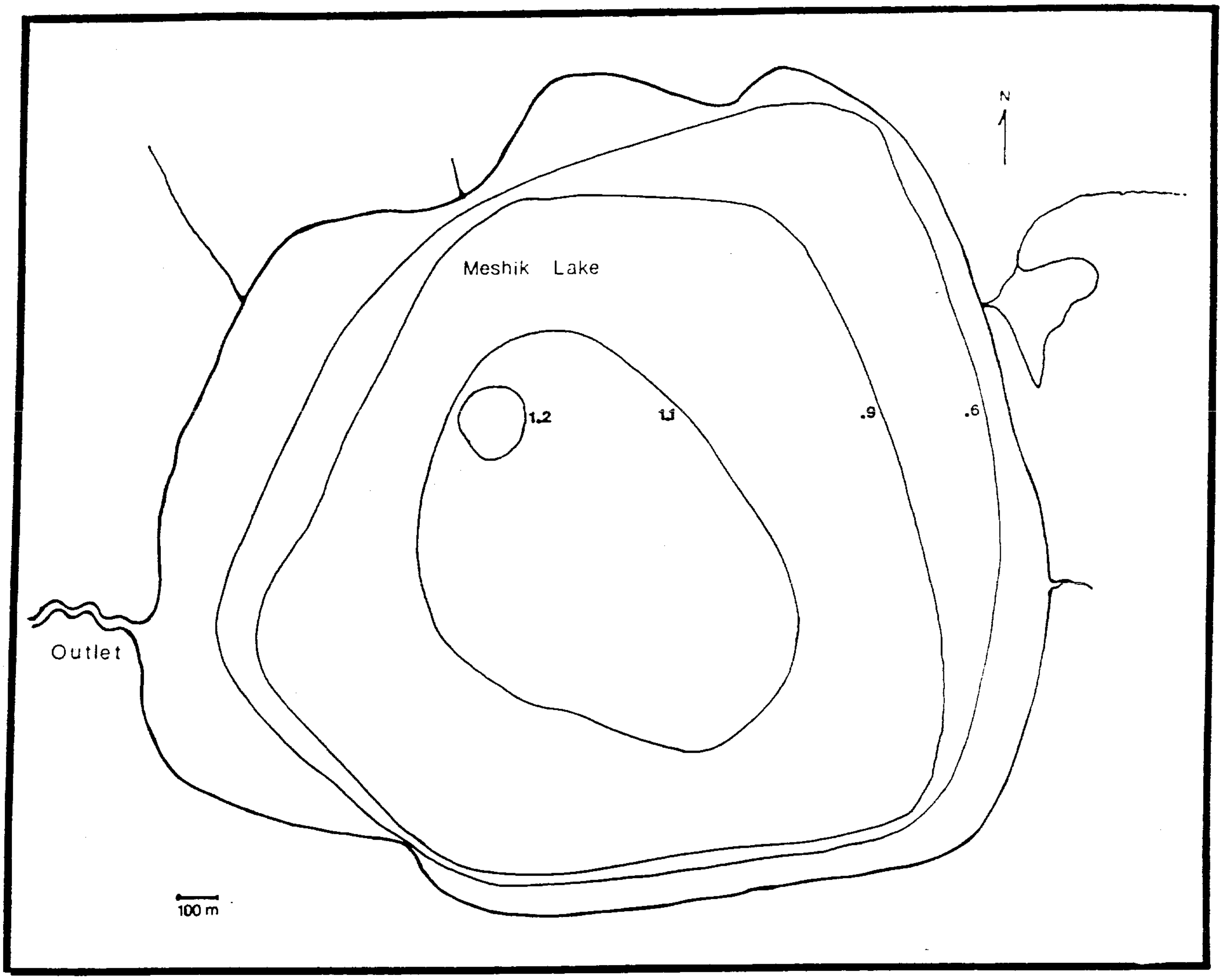
tributaries is classified as a barrens ecosystem (Anonymous 1985). There is no record of permafrost in this drainage basin.

Meshik Lake

Meshik Lake is located 69.5 km upstream of the river's confluence with Port Heiden Bay. Both the outlet and lake provide rearing habitat for juvenile salmonids. It is 26.7 ha in area, shallow (< 1.2 m) and has a flat bottom (Figure 2). The lake bottom and shores are predominately sand and gravel with some silt. Two small streams (< 1 m wide, < .3 m deep) and a large area of springs and seepages are present along the south shore. A ridge, 2 m high, parallels the east shore of the lake about 10 m from the shoreline. Two streams, originating from small ponds and wetlands, bisect the ridge to enter the lake. One dry stream bed and several small spring-fed streams are located along the north shore of the lake at the base of Pinnacle Mountain. Beaver dams on small streams draining the area west of the lake have flooded a wide expanse of tundra. At the lake outlet, located at the west side of the lake, the river is sluggish with a hard sand and gravel bottom; it is about 1 m deep.

Meshik River Main Stem

The Meshik River is divided into two distinct sections at Cub Creek. Above Cub Creek is a continuous series of sharp bends, with gravel, sand and rubble providing excellent spawning substrate. Areas of exposed bedrock are also present. The stream channel is bordered by cut banks on the outside, and



Surface Area : 26.7 hectare

Length : 640 m

Maximum Breadth : 595.5 m

Maximum Depth : 1.2 m

Mean Depth : 0.8 m

Relative Depth : 0.7 m

Volume : 220,791 m^3

Shoreline Length : 1,954 m

Shoreline Development : 1.1

Littoral Area : 100%

Figure 2.-Depth contours and morphological characteristics of Meshik Lake, Alaska, measured 3 June 1984.

gravel bars on the inside, of each bend. Pools at each bend provide holding areas for adult fish. Rearing habitat (i.e., where small fish were observed) is limited to the pools and slower water next to stream banks. The average gradient from the headwaters to the confluence of Cub Creek is 9.7 m/km. Water clarity was judged to be highest in this section of river throughout the summer. The riparian area is dry tundra (grasses, forbs, mosses and lichens) with some willow.

The river below Cub Creek is straighter, wider, and more uniform in depth. The river continues to widen at the confluence of each large tributary, but this increase is most noticeable downstream of Wolf Creek and Blue Violet Creek. River gradient averages 0.2 m/km from Cub Creek to Port Heiden Bay. Bottom substrate is predominately sand and silt with scattered gravel areas. The many tributaries and springs that enter the river provide potential salmonid rearing habitat, but the combination of low water velocity and the absence of gravel provides poor spawning. The riparian zone consists of grasses and forbs, with occasional alder and (or) willow. Stream banks gradually change from cut banks to gentle slopes as the river nears the confluence of Lower Y Channel.

Y Channel System

More than half of the main stem discharge (unpublished data, U.S. Fish and Wildlife Service, King Salmon, Alaska) flows into the Upper Y Channel, located approximately 3 km upstream of Scotty's Island, and then rejoins the main stem 3 km downstream of Scotty's Island, at the confluence of Braided Creek (Figure 1). Where Upper Y Channel branches off, it has well-vegetated steep banks, deep pools at channel bends, predominately sand substrate and narrow width (< 50 m) relative to the Meshik River (> 100 m). Water from Upper Y Channel flows through Y Lake into Lower Y Channel. Y Lake is less than 20 cm deep, except in an ill-defined channel, 1 m deep, traversing the lake to the lake's outlet. The lake bottom is a sand and silt mixture; aquatic plants are sparse. Lower Y Channel is joined by a small stream near the lake outlet. Lower Y Channel is physically similar to Upper Y Channel.

Blue Violet Creek

Blue Violet Creek originates from steep mountain tributaries and numerous small springs 33 km upstream from its confluence with the Meshik River. Headwater stream channels are small (< 3 m wide), with 50 percent pools and 50 percent riffles, and have a substrate mixture of small gravel and coarse sand. Between the headwaters and an area 11 km above the confluence with the Meshik River, noted as the "narrows", the following changes occur: 1) the main channel increases to a width of 4 to 8 m and up to 1 m in depth; 2) channel boundaries become less defined with gravel bars on both sides of the stream; 3) the channel becomes a combination of riffles (<.3 m deep) and rapids with few pools or holding areas for fish; and 4) gravel becomes more predominant in the substrate. Average gradient is 28 m/km.

Between the narrows and the confluences of Black and Sleepy Creeks, Blue Violet Creek is a series of pools and riffles (gradient = 3.8 m/km) with a well defined channel, varying between 15 m and 21 m wide and generally less than 1 m deep. A cut bank on one side and gravel bar on the other are typical channel boundaries. Small tributaries (< 1 m wide, < .3 m deep) are common. The riparian zone is a mixture of willow, grasses and forbs. However, the majority of the drainage has a very fragile covering of top soil, usually less than 4 cm over a rock or rock scree base. A 20 year old roadbed is evident throughout the drainage and appears to be eroding in several areas. Once the road crosses Portage Pass to the Pacific side of the peninsula it is less visible due to a denser growth of vegetation, especially alder. Below the confluences of Black and Sleepy Creeks, Blue Violet Creek widens to approximately 23 m and the stream substrate begins a transition from primarily gravel to a sand and gravel mixture. The gradient is < 2 m/km in this section of stream.

Braided Creek

The headwaters of Braided Creek (Figure 3) are mountain tributaries and glacial streams. Exploratory mining sites are located on steep northern slopes of several mountains in the headwater area. Waterfalls and boulder-strewn rapids are prevalent in the upper stream sections, with some potential rearing habitat observed (pools and springs entering as small tributaries). The upper channel is relatively straight and narrow (< 15 m wide) with a high gradient (33 m/km). Stable, well vegetated banks occur throughout this segment, and the creek bottom is typically composed of a gravel, rubble and sand mixture.

The creek changes character dramatically as it flows through a wide (1.5 km) floodplain, becoming braided with a gravel, sand and rubble substrate and gravel banks. The channel gradient decreases to 6 m/km. This section of creek appears to provide poor fish rearing habitat because of: 1) small (3 to 12 m wide, < 1 m deep) and unstable channels (indicated by numerous uprooted alder trees in the floodplain); 2) lack of vegetative cover, pools or slow water

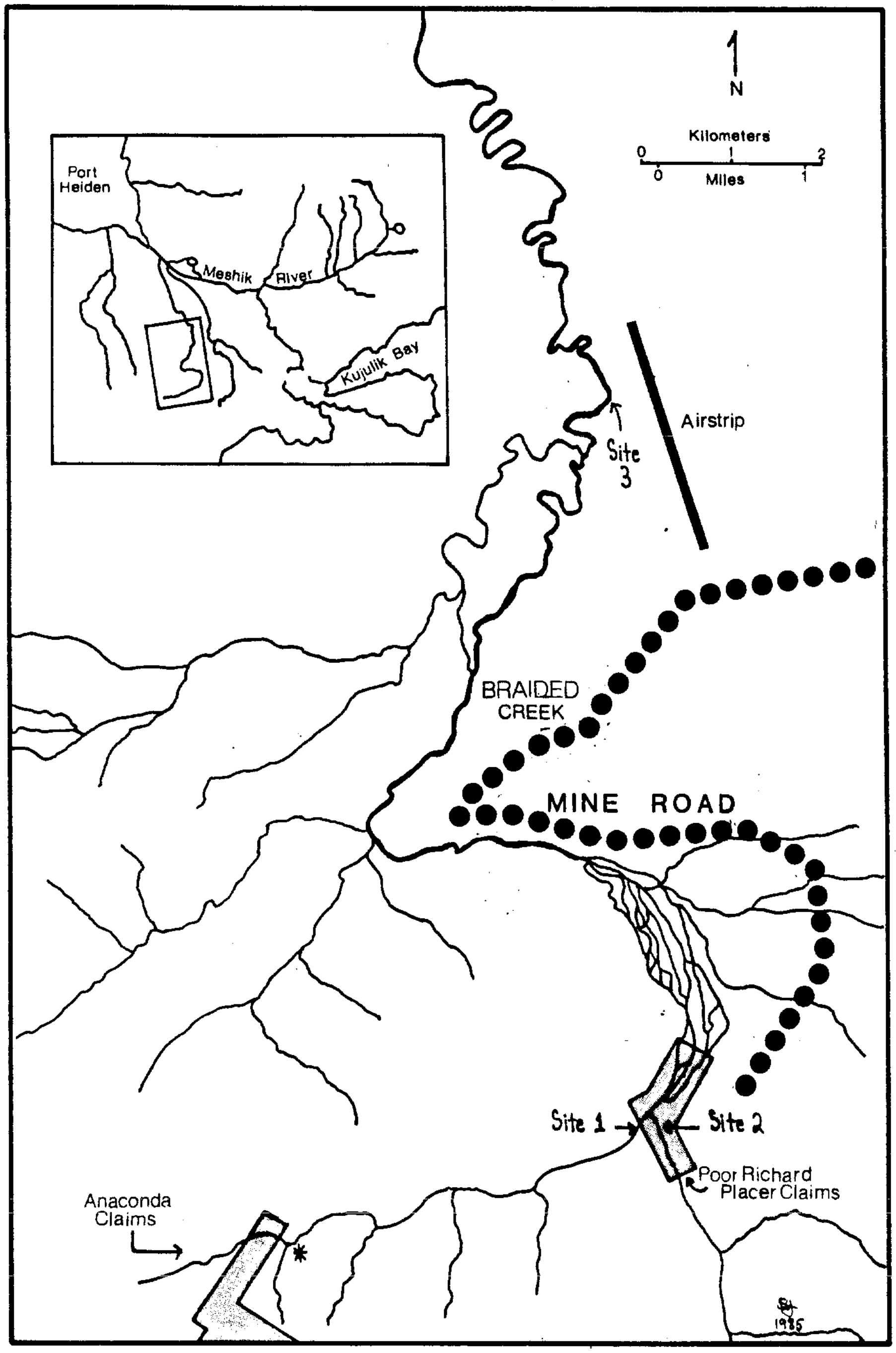


Figure 3.-Upper Braided Creek showing upstream extent of fish sampling and water sample collection sites.

areas; and 3) large discharge fluctuations (no water was present in the lower half of the braided area during a 10 October 1984 aerial survey.

The creek converges to a single channel at the north end of the gravel flood plain where several tributaries join it. At this point the creek gradient decreases to 2 m/km, the main channel again becomes well defined by vegetated banks, and both riffle and pool areas are present. The substrate is gravel, sand and rubble. The channel braids again after a sharp northeast change in creek direction and remains braided until it flows by the airstrip. Banks in this braided section have shrubs and other riparian vegetation growing on them, but are considered unstable because of recent sloughing scars. Substrate is predominately gravel.

Downstream of the airstrip, Braided Creek has a series of meanders, which provide extensive rearing habitat in deep pools and frequent small backwaters. The stream gradually widens (up to 45 m) and straightens into a shallow channel with a sand substrate interspersed with areas of silt and gravel. The gradient is 0.5 m/km. The riparian area changes below the braided section to predominately grasses and forbs. Several established islands and exposed sandbars are present in the lower section of river during July.

METHODS

Fish were sampled from Meshik Lake to near the confluence of the Meshik River and estuary of Port Heiden Bay. Two Meshik River tributaries, Braided Creek and Blue Violet Creek, were sampled upstream to their headwaters or until impassable fish barriers occurred. No other Meshik River tributaries were sampled beyond two bends upstream of their confluence with the Meshik River.

Table 11.-Water quality, fourteen tributaries and the Meshik River main stem, 1984.

Stream name	Date	Temperature (°C)	pH	Dissolved oxygen (mg/l)	Alkalinity (mg/l)
Blue Violet Creek	7 June	-	7.2	-	12.0
Braided Creek (mouth)	26 June	9.0	7.0	11.4	16.0
Braided Creek (headwaters-site 1[a])	7 July	6.0	6.5	12.6	3.0
	8 July	4.0-5.5	6.5-6.8	12.4-12.9	2.5-3.5
Braided Creek (headwaters-site 2)	7 July	6.5	7.0	13.0	13.8
	8 July	4.0-5.0	6.8-7.0	12.1-13.0	14.0-16.0
Braided Creek (west of airstrip-site 3)	9 July	9.0	7.0	11.3	18.5
Caribou Antler Creek	4 June	14.0	6.8	9.2	12.0
Cub Creek	4 June	15.0	7.2	10.0	14.0
Landlocked Creek (near lake outlet)	15 June	12.0	7.0	6.3	8.0
Landlocked Creek (Scottys Island)	3 July	14.0	7.5	9.7	6.3
	15 August	14.0	7.0	10.7	25.5
Meshik Lake outlet	5 June	18.0	8.8	9.9	13.0
Meshik River (site 6 channel)	15 August	15.0	7.5	10.4	31.3
Meshik River (Scottys Island)	13 June	13.0	7.0	10.8	15.5
	3 July	13.0	7.5	10.6	13.0
	20 July	15.0	7.0	10.8	22.9
Paddle Creek	6 June	8.0	7.2	11.6	16.5
Plenty Bear Creek	7 June	8.5	7.0	-	20.0

[a]Range of values measured during 14 hours of testing (0630 hrs to 2030 hrs) on 8 July.

Table 11.-Continued.

Stream Name	Date	Temperature (°C)	pH	Dissolved oxygen (mg/l)	Alkalinity (mg/l)
Rainbow Creek	5 June	10.0	7.0	11.8	10.0
Rust Creek	5 June	17.0	6.2	8.8	22.0
Shoe Creek	5 June	8.0	6.8	11.9	16.0
Upthe Creek	6 June	12.0	6.8	-	6.0
Waterfall Creek	5 June	19.0	7.0	10.4	11.0
Wolf Creek	6 June	13.0	6.8	-	13.0
Range of values		8.0-19.0	6.2-8.7	6.3-11.8	6.0-25.5

Minnow traps baited with preserved salmon eggs, fyke nets (1 cm mesh) and dip nets were used to capture fish less than 13 cm in length. All measurements were made in English units and then converted to metric. Larger fish were captured by experimental or single mesh gill nets fished passively or used as a seine, and by hook and line. The experimental gill nets were 46 m by 2 m and contained six, 7.6 m mesh panels with stretched mesh sizes ranging from 3.8 cm to 10.2 cm in 1.3 cm increments.

The effort varied depending on the type of gear used for collecting juvenile anadromous salmonids and resident fish species. Minnow trap sampling effort varied from 1 to 48 hours of fishing time. Minnow trap sites were established within a 3 km radius of Scotty's Island (Figure 4) to determine species temporal distribution, relative abundance and changes in age class composition. These sites were sampled at various intervals and intensities with fishing effort ranging from 2 to 4 hours.

Minnow trap-catch-per-unit effort (CPUE) data were tested to see if statistically significant differences ($P < .05$, where P=alpha=probability of a Type I error) in catch occurred during the field season. To test the null hypothesis that minnow trap CPUE was constant, a nonparametric Theil distribution-free test for the slope coefficient (Hollander and Wolfe 1973) was used.

A fyke net was set in Landlocked Creek on the south side of Scotty's Island to record species temporal distribution. The fyke net was set at sundown 1 to 4 times a week and allowed to fish up to 11 hours per set between 23 May and 21 June. An overnight set was made with the experimental gillnet in Meshik Lake from 1 - 2 June. A dip net was the only sampling gear used during a hike from Blue Violet Creek to Hook Bay. Dip nets were also used on an

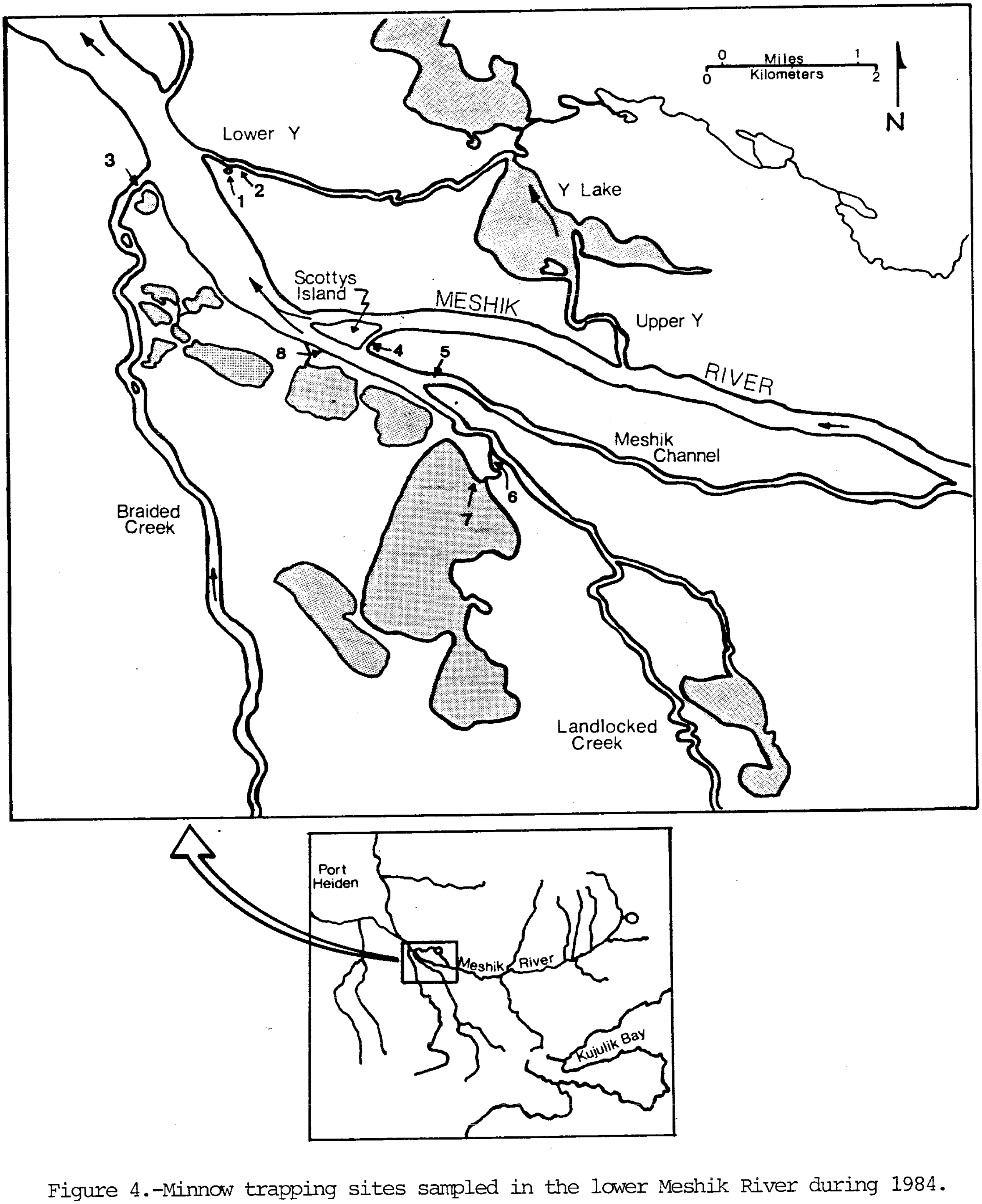


Figure 4.-Minnow trapping sites sampled in the lower Meshik River during 1984.

opportunistic basis throughout the summer in other areas of the Meshik River drainage basin.

Gill nets were used to seine adult salmon when fish were observed in wadeable sections of Landlocked Creek and in the Meshik River. A gill net was set for various lengths of time between 9 - 17 August in Landlocked Creek on the south side of Scotty's Island to capture adult coho salmon (Oncorhynchus kisutch) swimming upstream and spawned-out sockeye salmon (O. nerka) drifting downstream. Hook and line were used whenever possible to document adult fish presence, and to collect scales and morphological information.

Sampling for adults occurred during most of the time fish were present in the lower Meshik River and the sample size for each species is believed large enough to have included all age groups. However, sample sizes are insufficient for calculating the percent age class composition or sex ratios for fish populations returning to spawn in the Meshik River. Weights are not included in the tables because fish were collected at various stages of maturity (i.e., ripe, spawned out, etc.), and nets (used to hold the fish while being weighed) were inconsistently tared.

Fish were anesthetized with tricaine methane sulfonate (MS222) for ease of handling and released after identification; length and weight measurements and scale samples (salmonids only) were collected. Fork length was measured for juvenile and resident fish species; compressed total length (Hile 1945) was also measured from a subsample of juvenile coho and chinook salmon. Simple linear regression was used to develop formulas for converting total length to fork length. Lengths of adult salmonids were measured from mid-eye to fork. Scales were removed from the left side of adult fish between the posterior of the dorsal fin and the lateral line. A scale smear was taken from the same location on juvenile fish. Sex was determined from secondary sex characteristics of adult fish.

All scales were aged according to techniques described by Koo (1962). Impressions of adult scales were made on cellulose acetate cards, magnified on a microprojector from 20 to 60 times and aged by Alaska Department of Fish and Game personnel. National Fisheries Research Center personnel aged Dolly Varden (Salvelinus malma) scales. Regenerated scales were discarded. Juvenile salmonid scales were read using a dissecting microscope. All scales were aged according to techniques described by Koo (1962).

Aerial surveys to count live fish and identify spawning areas on the main stem and 14 tributaries were conducted from small, fixed-wing aircraft on: 23 July, 6 and 12 August, 13 September, and 15 October. Fish identification was based on timing, size and color of fish. Chum salmon (O.keta) were counted in groups of 100, sockeye salmon in groups of five, and chinook (O. tshawytscha) and coho salmon in groups of five or individually (if few fish were present). Areas having a gravel substrate and distinct pairs of like species of fish present were classified as spawning areas.

Salmonid spawning and rearing distribution maps were developed using historical data (Alaska Department of Fish and Game 1982) and 1984 aerial surveys. Distribution maps were used to determine the spawning and rearing areas that could be affected by the development of the proposed transportation corridor. The upstream boundaries of rearing and migration areas were defined as the upstream boundary of spawning for each species; downstream boundaries were the confluence with the Meshik main stem (Meshik River tributaries) or the Port Heiden estuary (i.e., streams that are not tributaries of the Meshik River).

Surface water samples were collected from all second-order and greater tributaries to the Meshik River, upstream of Scotty's Island, during 2 - 7 June 1984. Water samples were also periodically collected from the Meshik River near Scotty's Island, from Braided Creek near the Braided Creek airstrip, and at two locations in the headwaters of Braided Creek (Figure 5). Water samples were analyzed for dissolved oxygen, alkalinity, and hydrogen ion concentration (pH) using a Hach[1] Model AL-36DT portable water chemistry kit. Water temperatures were measured to the nearest 0.5 C using a hand-held thermometer.

A bathometric map of Meshik Lake was developed using a Humminbird flash-type portable depth finder to record depth changes along predetermined transects. Lake morphological characteristics were defined and calculated using methods and descriptions in Hutchinson (1957).

[1]Use of trade names is for reader information only, and does not constitute endorsement by the U.S. Government of any commercial product or service.

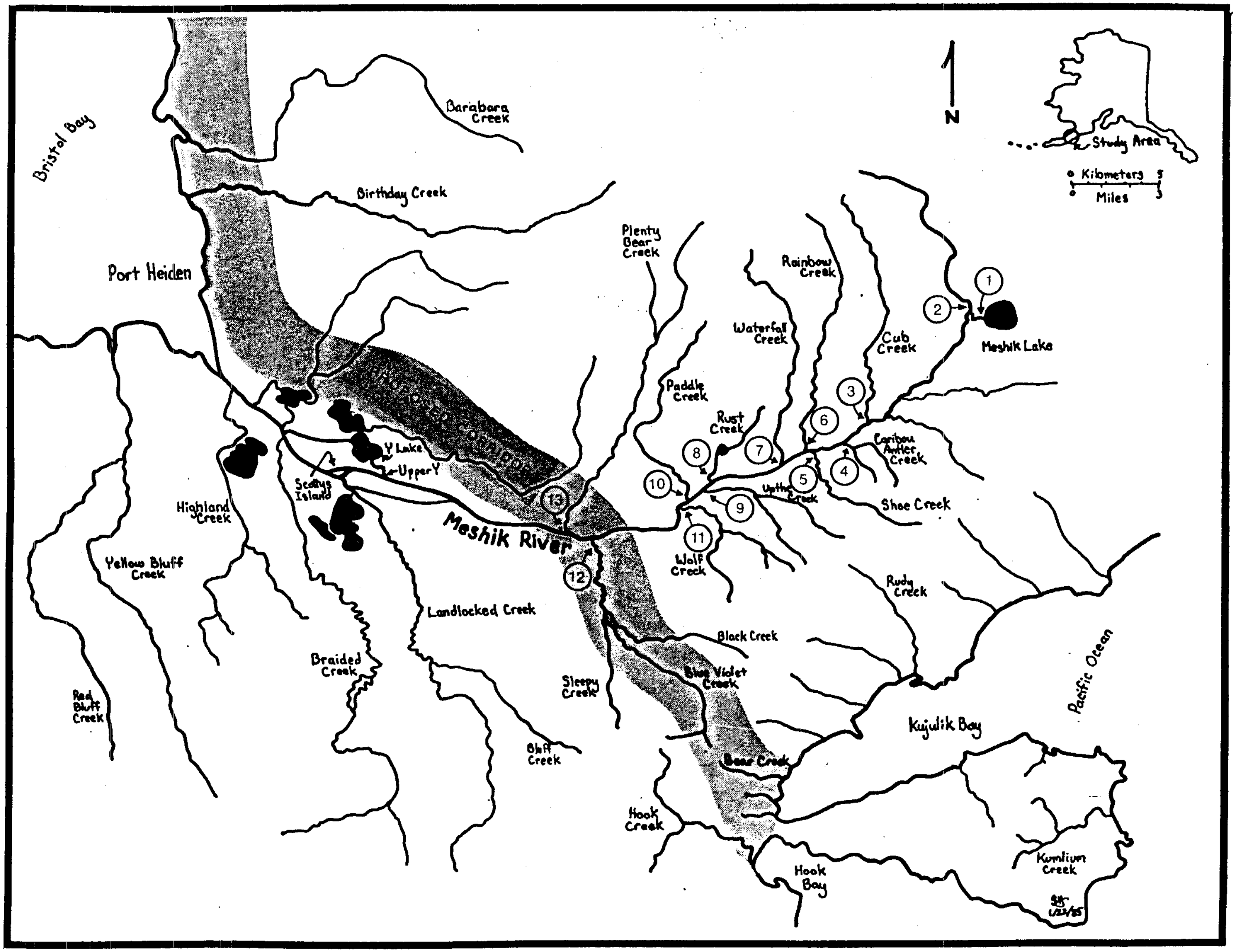


Figure 5.-Upper Meshik River water sample collection sites, 1984.

RESULTS

Juvenile Salmonids and Resident Fishes

The known Meshik river drainage area distribution of chinook, coho, and sockeye salmon; Dolly Varden; coastrange sculpin (Cottus aleuticus); threespine (Gasterosteus aculeatus) and ninespine (Pungitius pungitius) stickleback; Alaska blackfish (Dallia pectoralis); and starry flounder (Platichthys stellatus) is shown in Figure 6. The main stem upstream distribution of coho and sockeye salmon corresponds to the upstream limits of sampling that occurred during a 2 - 7 May 1984 float trip of the Meshik River; it is probable that juvenile coho and sockeye salmon are present further upstream in the main stem. Juvenile coho salmon and Dolly Varden distributions in Hook Creek were observed during a foot survey of the pipeline corridor.

Table 2 lists the average lengths and weights of a subsample of collected juvenile anadromous salmonids and resident fish. Length frequency histograms of juvenile salmon collected from the Meshik River drainage are shown in Figure 7 (chinook), Figure 8 (coho), and Figure 9 (sockeye).

Based on minnow trap catch data for all sites combined (Figure 7), all chinook salmon, age 1 and age 2, had migrated downstream out of the Meshik River by 21 June. All of the fish caught during the remainder of the summer were age 0 fish, except for one age 1 fish caught in August. Coho salmon minnow trap data for all sites combined (Figure 8) indicate that age 0 fish were present in the Meshik River all summer. Age 1 fish were also present all summer, although fewer fish were found after July. Age 2 fish appear to have migrated out of the system by the end of June.

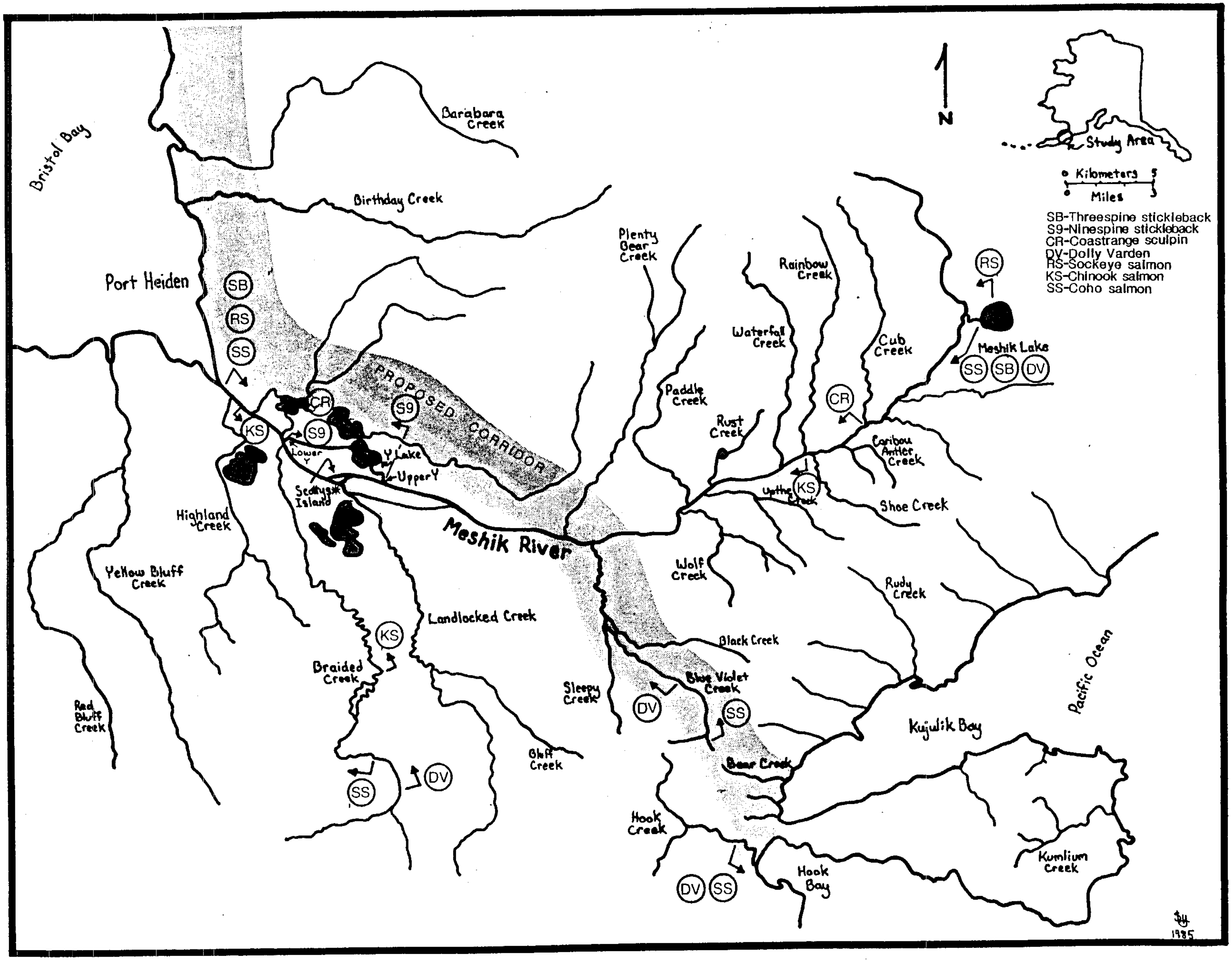


Figure 6.-Resident fish and juvenile anadromous salmonid distributions in the Meshik River main stem, Blue Violet Creek, Braided Creek and Hook Creek, Alaska.

Table 2.-Length and weight statistics for a subsample of juvenile salmonids and resident fishes collected from the Meshik River, Alaska, during 1984.

Species		Fork length (mm)	Weight (g)
Chinook salmon			
All ages	$\bar{X}$:	77.0	5.4
	N:	80	80
	SE:	1.64	0.23
Coho salmon			
Age 0	$\bar{X}$:	50.3	1.6
	N:	7	7
	SE:	0.43	0.09
Age 1	$\bar{X}$:	64.6	3.2
	N:	186	186
	SE:	0.01	0.05
Age 2	$\bar{X}$:	110.8	13.9
	N:	63	63
	SE:	0.19	0.07
Sockeye salmon			
All ages	$\bar{X}$:	45.0	1.0
	N:	6	6
	SE:	4.24	0.3
Dolly Varden			
All ages	$\bar{X}$:	86.0	6.1
	N:	32	32
	SE:	04.7	1.0
Threespine stickleback			
All ages	$\bar{X}$:	45.0	1.6
	N:	26	26
	SE:	2.3	1.2
Coastrange sculpin			
All ages	$\bar{X}$:	73.0	4.6
	N:	38	38
	SE:	2.0	0.3
Ninespine stickleback			
All ages	$\bar{X}$:	49.0	
	N:	60	-
	SE:	0.5	

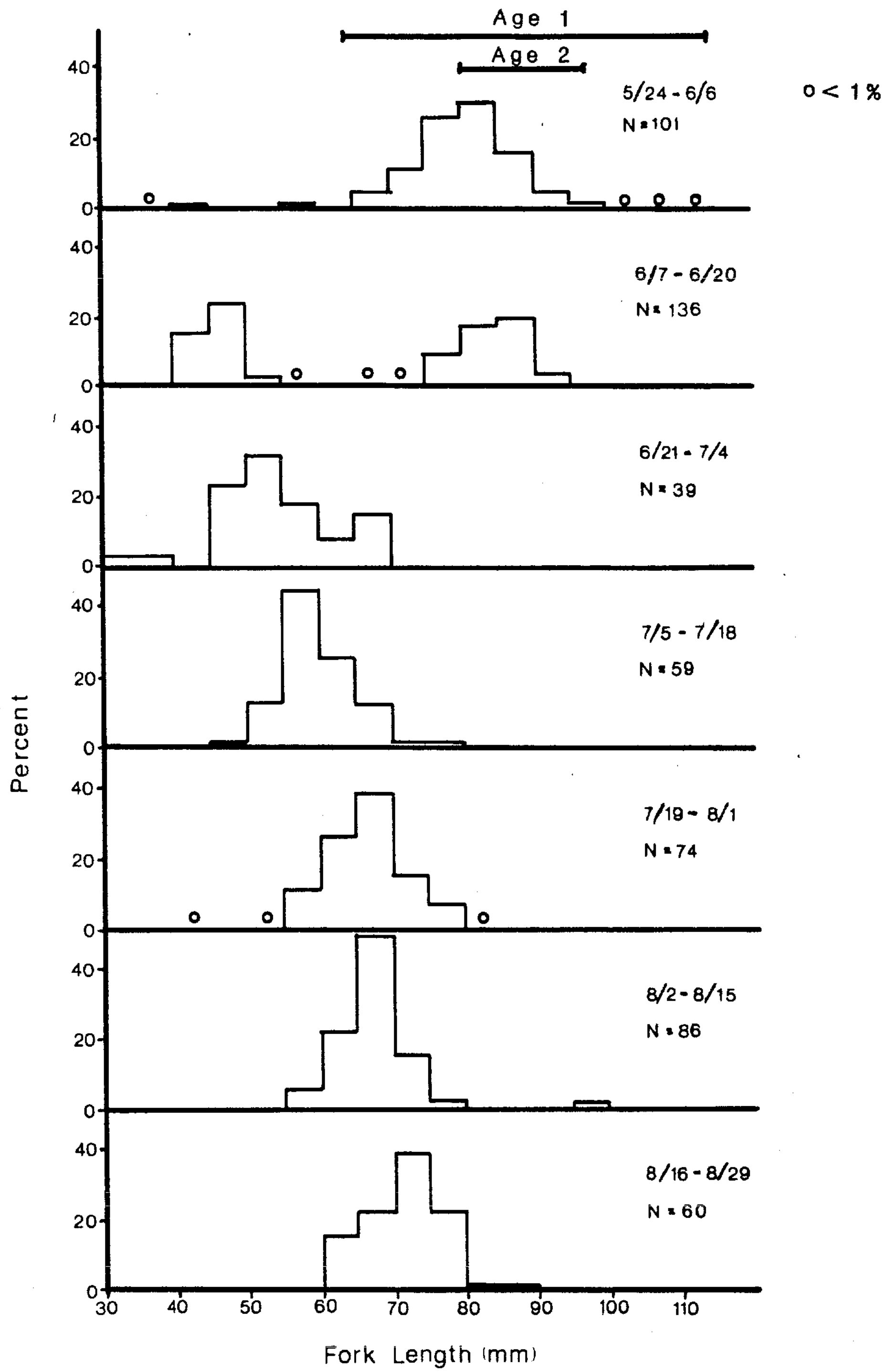


Figure 7.-Bi-monthly length frequency histograms for juvenile chinook salmon collected in minnow traps in the Meshik River 24 May to 29 August 1984.

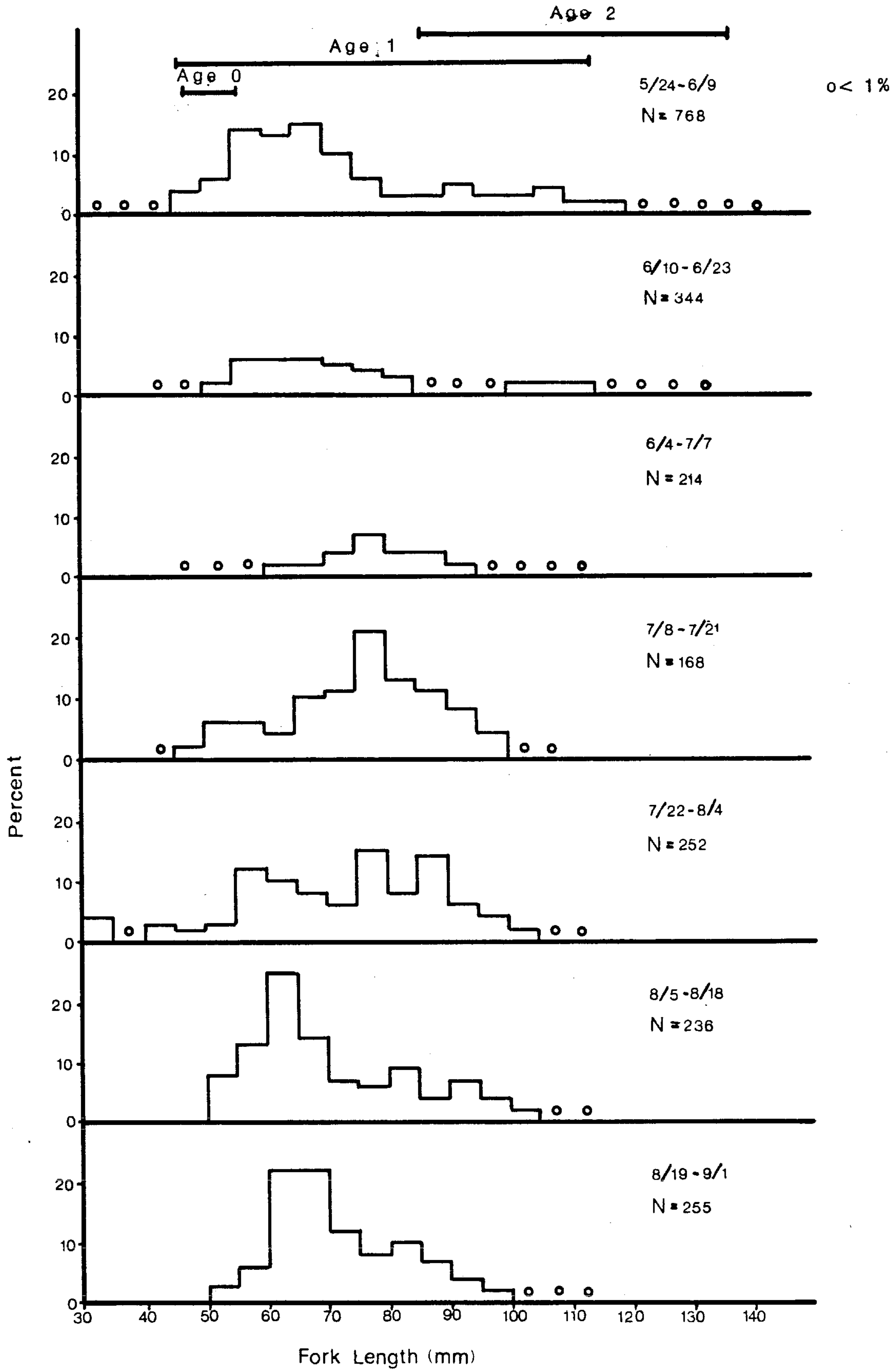


Figure 8.-Bi-monthly length frequency histograms for juvenile coho salmon collected in minnow traps in the Meshik River 24 May to 1 September 1984.

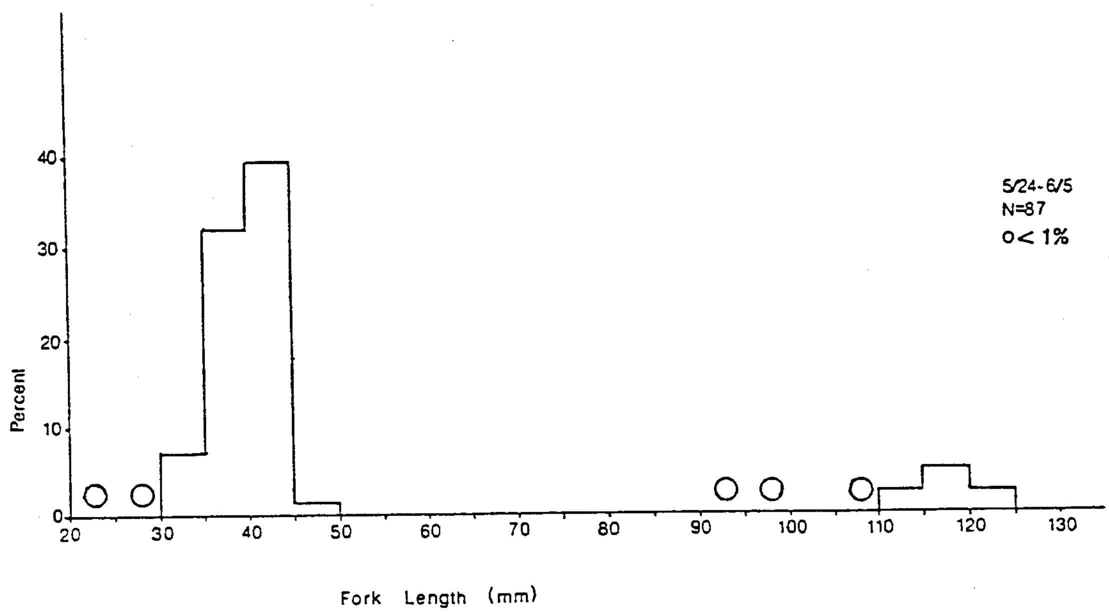


Figure 9.-Length frequency histogram for juvenile sockeye salmon collected in the minnow traps in the Meshik River 24 May to 1 September 1984.

Minnow trap CPUE did not vary over time for chinook and coho salmon ($p<.05$) (Table 3) except at sites 4 and 8 for chinook salmon and 4 and 5 for coho salmon, with CPUE increasing over time for these sites (Figure 10).

The formula for converting total length (TL) to fork length for juvenile coho salmon is:

$$y = 0.95(TL) - 2.04,\ r^2 = 0.90 \text{ and } n = 205.$$

The formula for converting total length to fork length for juvenile chinook salmon is:

$$y = 0.90(TL) + 1.13,\ r^2 = 0.99 \text{ and } n = 96.$$

Meristic characteristics of juvenile and adult Dolly Varden are listed in Appendix A. All fish were identified as Dolly Varden, based on pyloric caeca counts (Morrow 1980). Scale analysis of Landlocked Creek Dolly Varden indicated a three-year freshwater residency period prior to out-migration.

Adult Salmonid Distribrution and Biology

The upstream limits of adult Pacific salmon distributions (Figure 11) are based on observations during this inventory and Alaska Department of Fish and Game's 1960-1983 aerial surveys of the Meshik River drainage area (Alaska Department of Fish and Game 1985). Spawning areas, based on these same observations, are shown for chinook (Figure 12), chum (Figure 13), coho (Figure 14), pink (Figure 15) and sockeye salmon (Figure 16). Salmon counts from the 1984 aerial surveys are listed by stream name in Table 4. Salmon counts completed during this inventory should be considered as only indices of escapement because: 1) a limited number of surveys were conducted; 2) not all

Table 3.-Results of Theil distribution-free test of slope for significant changes in minnow trap CPUE for Meshik River sites sampled in 1984 (N = sample size and P = alpha = probability of Type I error).

	Coho		Chinook	
Site	N	P	N	P
1	7	.88	7	.66
2	8	.90	7	.27
3	5	.27	8	.27
4	9	.009	8	.006
5	9	.006	7	.098
6	9	.59	9	1.00
7	8	.55	9	.27
8	11	.25	11	.01

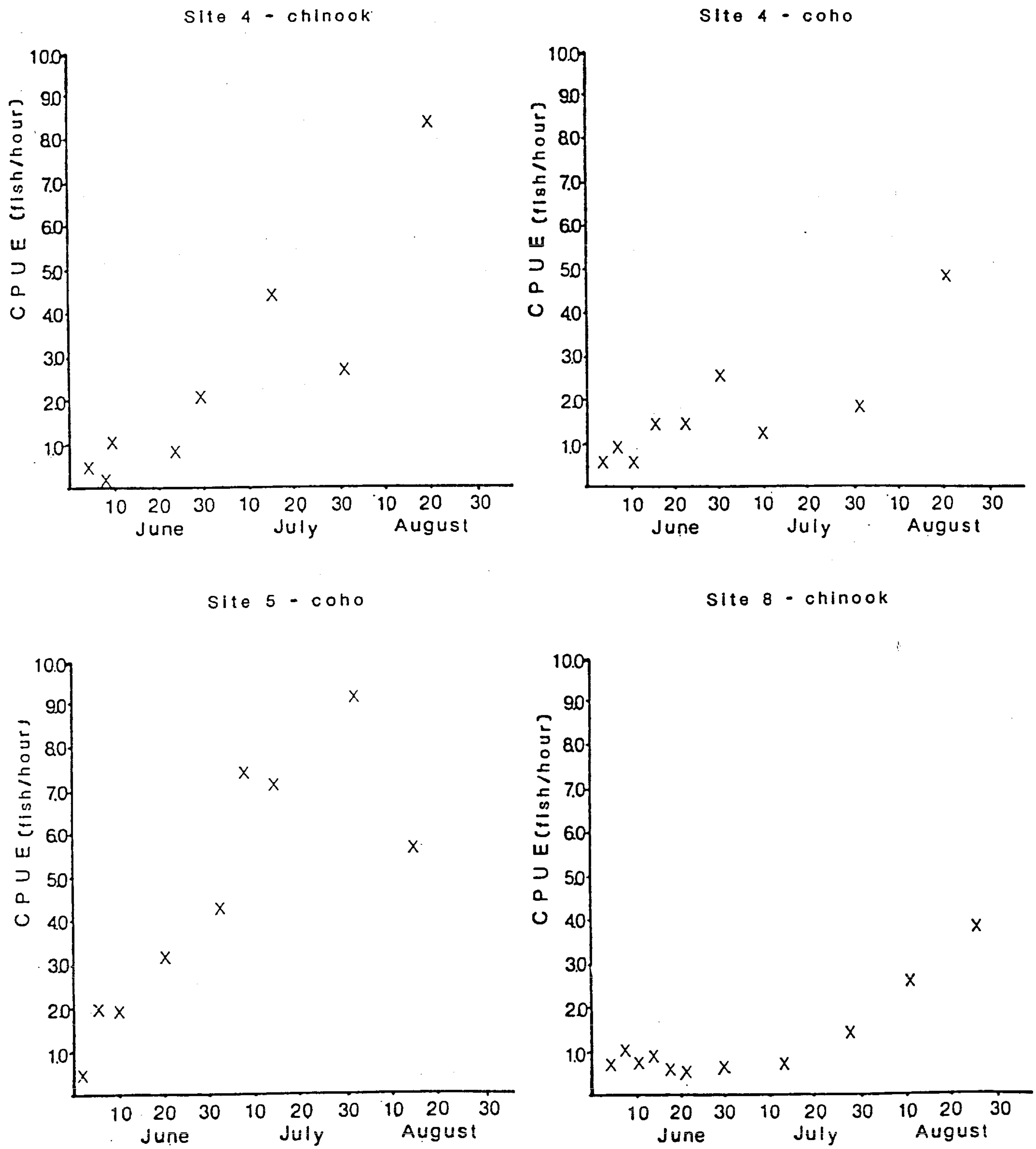


Figure 10.-Minnow trap catch-per-unit-effort (CPUE) data from selected sites on the Meshik River exhibiting significant (P<.05) changes in catch rate over the sampling period in 1984.

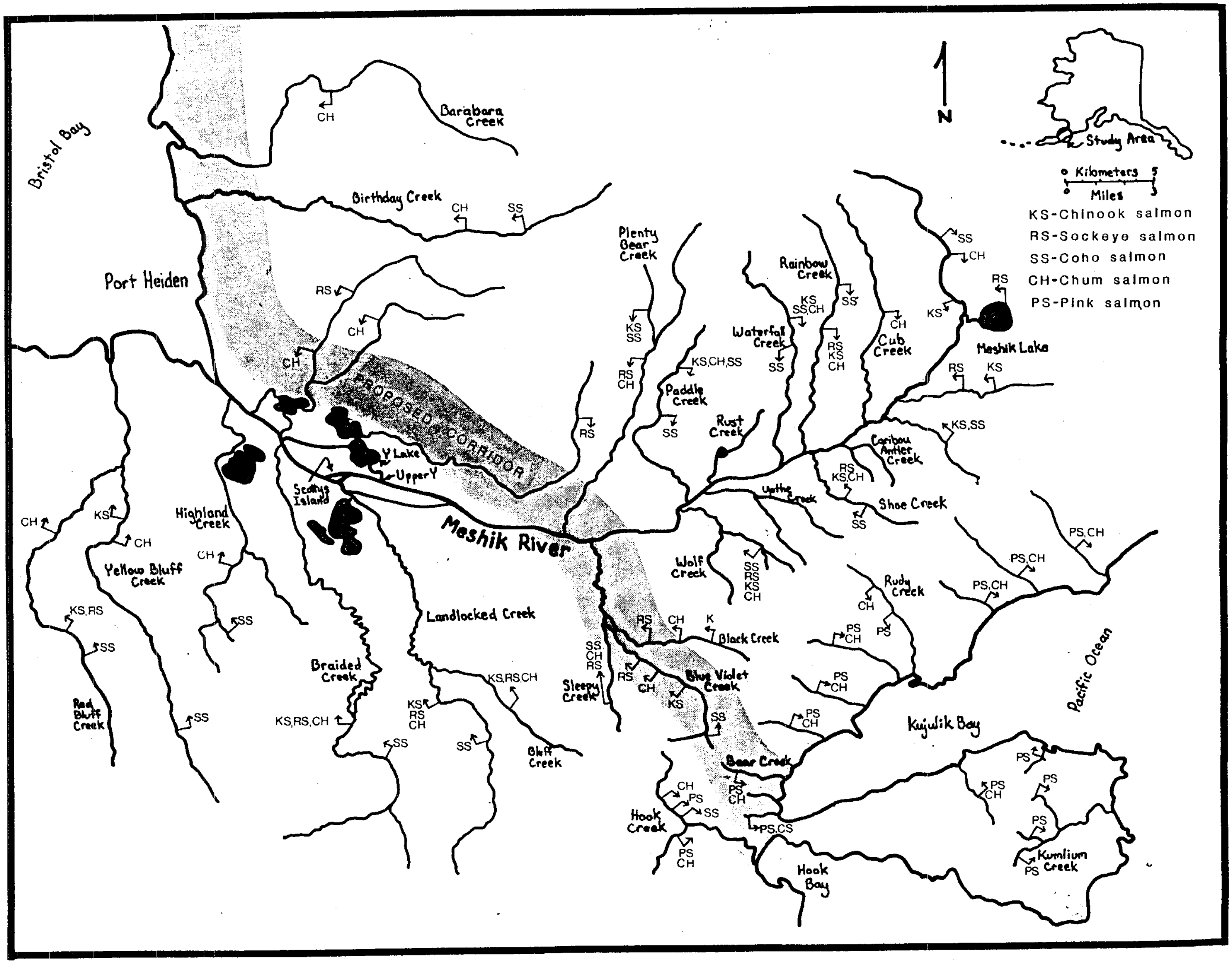


Figure 11.-Upper distribution of adult Pacific salmon in the Meshik River drainage basin and Kujulik Bay drainage basin areas, based on historical data and observations made during 1984.

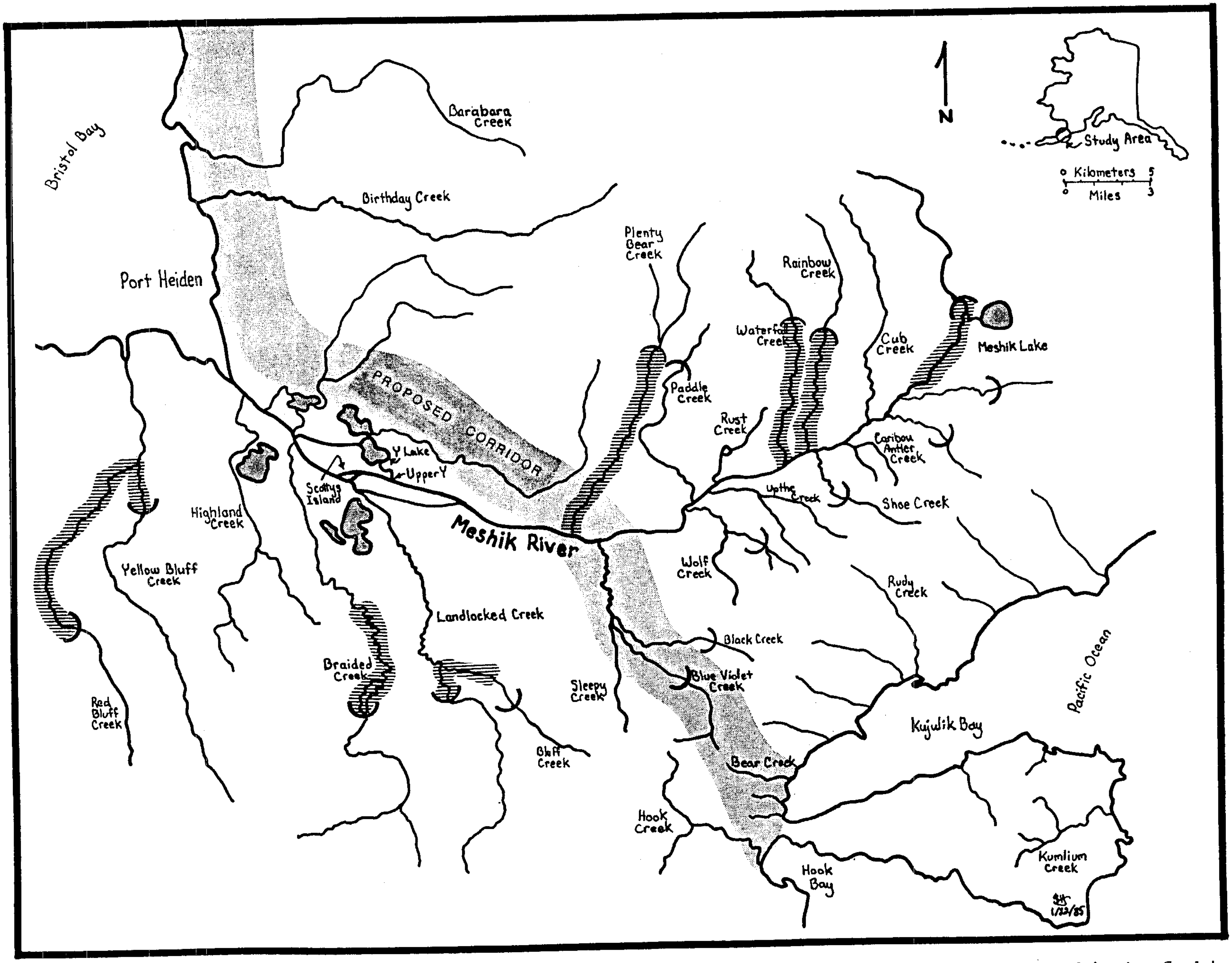


Figure 12.-Upper distribution (designated by half circle) and spawning areas (cross-hatching) of chinook salmon in the Meshik River and Kujulik Bay drainage basin areas, based on historical data and observations made during 1984.

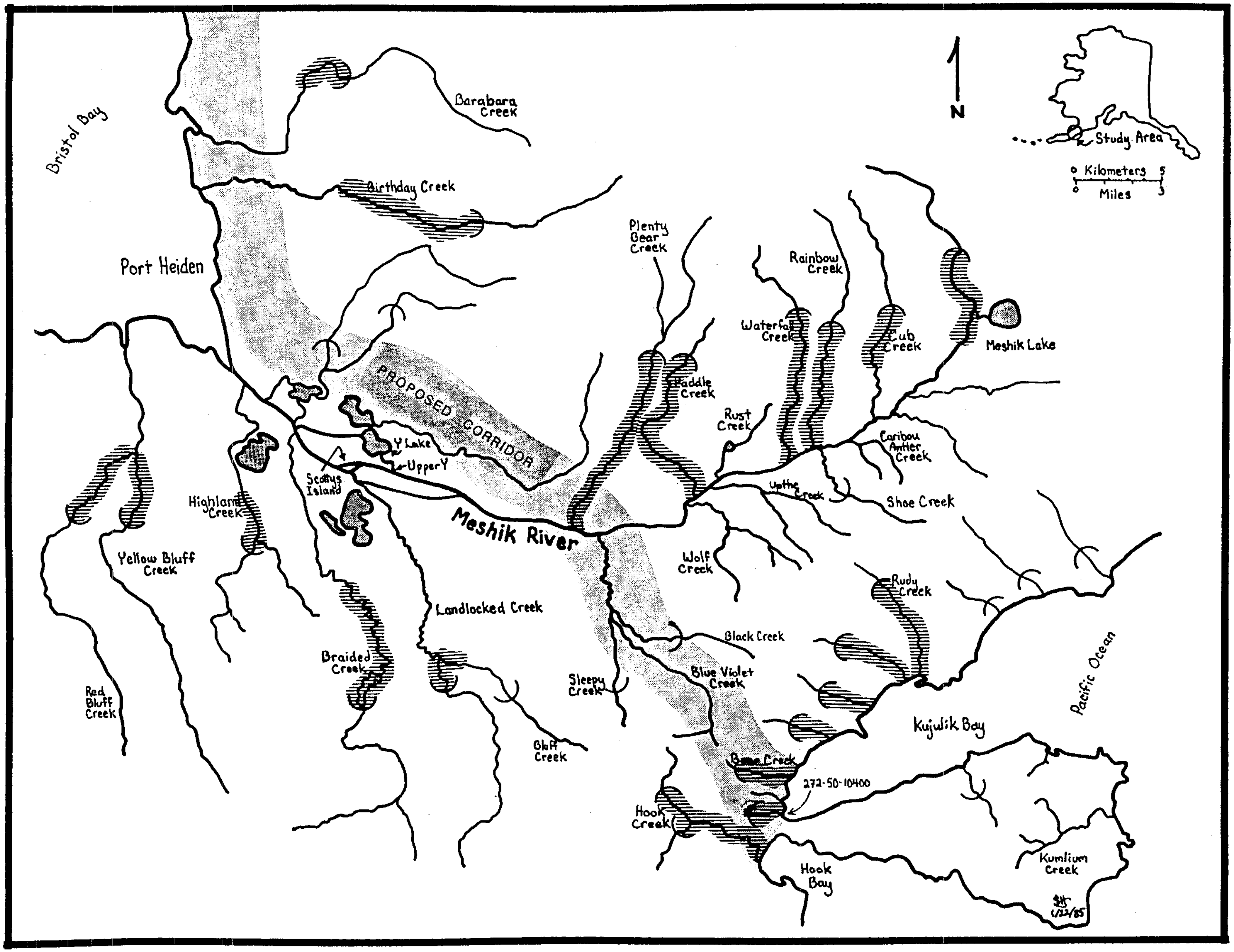


Figure 13.-Upper distribution (designated by half circle) and spawning areas (cross-hatching) of chum salmon in the Meshik River and Kujulik Bay drainage basin areas, based on historical data and observations made during 1984.

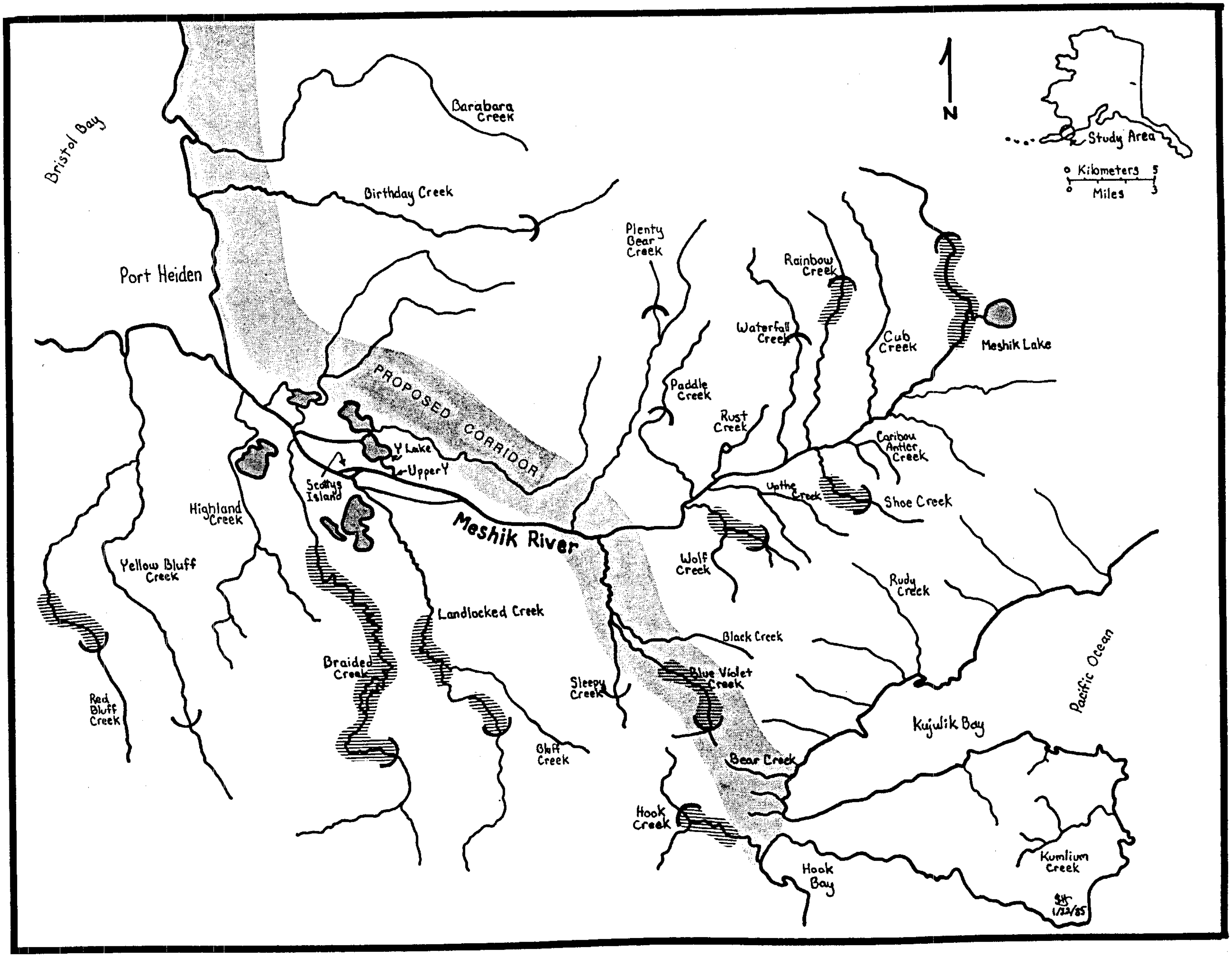


Figure 14.-Upper distribution (designated by half circle) and spawning areas (cross-hatching) of coho salmon in the Meshik River and Kujulik Bay drainage basin areas, based on historical data and observations made during 1984.

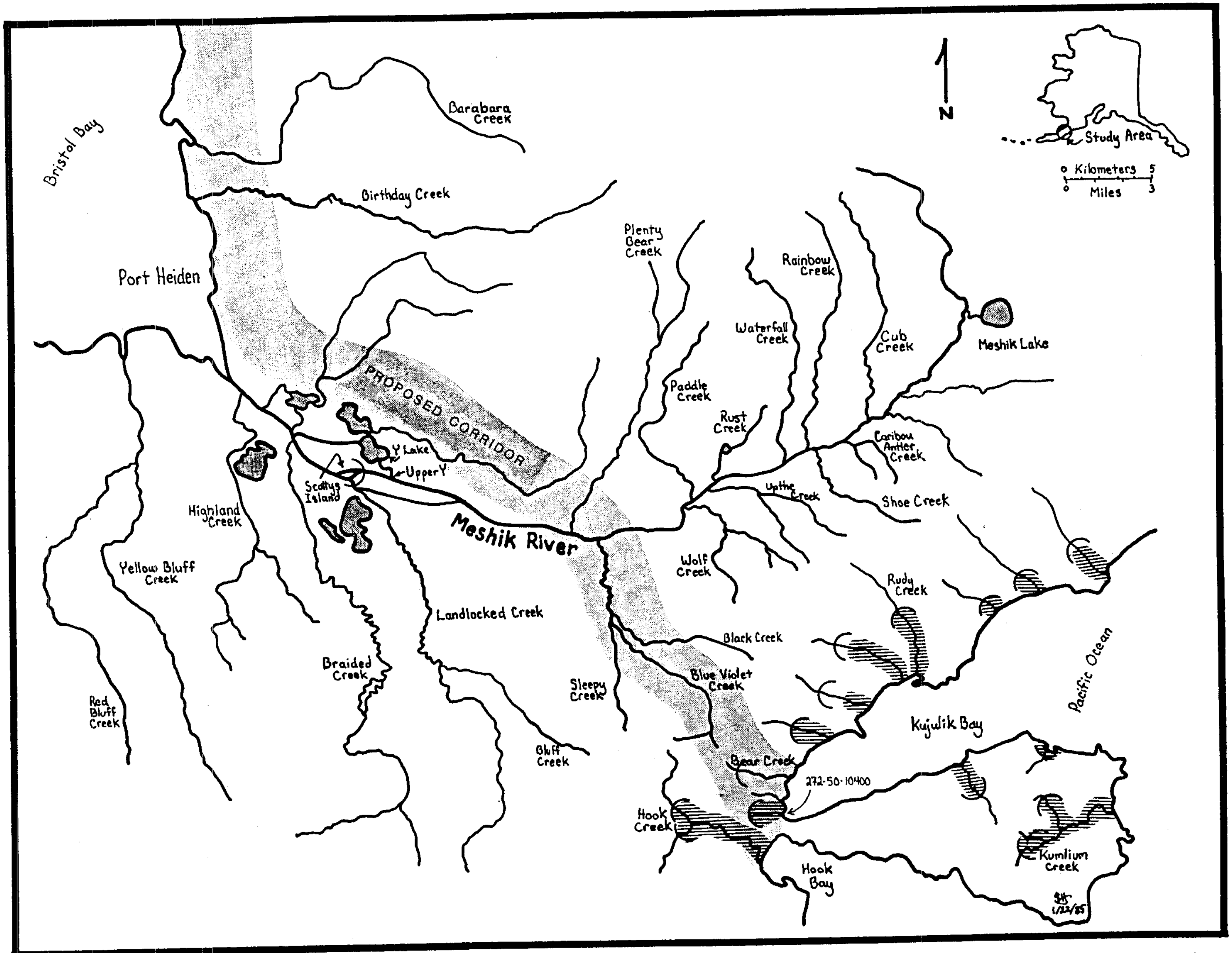


Figure 15.-Upper distribution (designated by half circle) and spawning areas (cross-hatching) of pink salmon in the Meshik River and Kujulik Bay drainage basin areas, based on historical data and observations made during 1984.

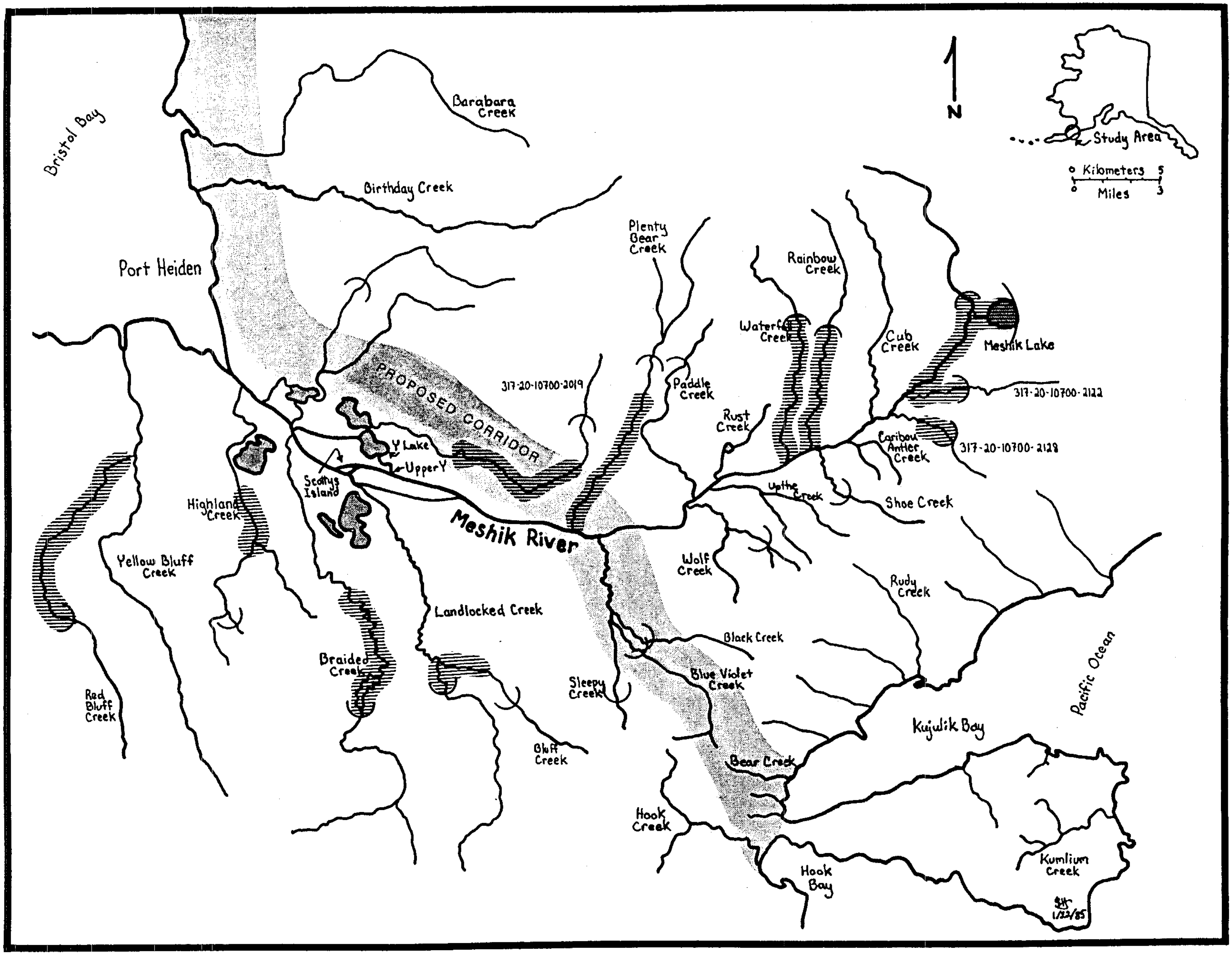


Figure 16.-Upper distribution (designated by half circle) and spawning areas (cross-hatching) of sockeye salmon in the Meshik River and Kujulik Bay drainage basin areas, based on historical data and observations make during 1984.

Table 4.-Estimated number of live adult salmon observed during five aerial surveys of the Meshik River drainage basin, Alaska, 1984. Abbreviations for fish are; KS = chinook salmon, CH = chum salmon, RS = sockeye salmon, and SS = coho salmon.

	Date								
	7/23			8/6			8/12	9/13	10/15
	Species			Species			Species	Species	Species
	KS	CH	RS	KS	CH	RS	KS	SS	SS
Stream name									
Birthday	150	100	0	-	-	-	0	495	-
Blue Violet	450	3200	300	40	1700	1500	70	685	2180
Braided	115	600	0	150	300	0	0	3870	1840
Cub	-	-	-	5	1200	0	-	40	0
Landlocked	195	900	250	5	20	0	-	930	2900
Meshik	120	2600	800	350	1500	1000	110	2395	1030
Paddle	35	5000	0	10	7400	0	-	-	-
Plenty Bear	185	4200	0	1320	4200	400	250	950	180
Rainbow	40	1700	0	0	0	0	500	395	270
Red Bluff	760	400	0	0	0	0	120	135	1800
Rust	-	-	-	0	0	0	-	-	-
Shoe	140	600	0	0	0	0	0	0	20
Waterfall	50	900	0	0	300	0	20	0	50
Wolf	205	6000	800	-	-	-	60	615	190
Yellow Bluff	875	420		125	300	80	50	1065	1200
Total	3320	26620	2150	2005	16920	2980	1180	11575	11660

streams were surveyed in their entirety; and 3) inexperienced observers were used to count fish. Salmon counts in the Meshik River drainage were completed by Alaska Department of Fish and Game personnel from 1960 to 1983 and are listed in Table 5. These counts are also indices of total escapement because survey effort varied greatly between years (e.g., observation periods and number of aerial surveys were not constant, different proportions of the watershed were surveyed each year, stream turbidity sometimes prevented accurate counts, etc.).

Chinook salmon were the first anadromous adults observed entering the Meshik River in 1984 (early June), followed by chum and sockeye salmon (late June), Dolly Varden (early July) and coho salmon (late August). Few pink salmon were captured (N=11), although they were present in the river for an extended period. The seasonal presence of adult salmonids, determined by hook and line sampling and aerial surveys, is shown in Figure 17.

Age (determined by scale analysis), sex and length statistics of adult salmonids are listed in Tables 6 to 9. Chinook salmon spent 1 year in fresh water and from 1 to 5 years in salt water, chum salmon spent 3 to 5 years in salt water, coho salmon spent either 1 or 2 years in fresh water, and 1 year in salt water, sockeye salmon spent 1 year in fresh water and either 2 or 3 years in salt water.

The number of kilometers of stream used by salmon for spawning and rearing in the Meshik River drainage basin that are crossed by either the proposed oil or hard rock mineral transportation corridor are listed in Table 10. An additional 168 km of drainage tributaries are known to contain adult fish (Alaska Department of Fish and Game 1982), and may provide additional spawning and rearing habitat.

Table 5.-Number of salmon counted in the Meshik River drainage from 1960 to 1983 by Alaska Department of Fish and Game personnel.

			Species		
Year	Coho	Chinook	Chum	Pink	Sockeye
1960	900		400		1620
1960	900		400		1620
1961	44				250
1962			100		
1963			350		1250
1964		1350	350		1355
1965			4300		1335
1966		761	300		1960
1967		150			3350
1968	500	100			18530
1969	5600	380			3500
1970	2690	252	21720		10117
1971	1765	165	10180		31740
1972	403	1454	20170		6588
1973	60	538	25297		20571
1974	2000	1043	3660		6879
1975		926	1285		3388
1976	1200	964	26010		65470
1977	200	550	16360	50	17630
1978		1755	9730		16140
1979		1005	200		43000
1980				50	12325
1981			2050		41025
1982		400	2400		18400
1983		120	4170		6310
1984[1]	11660	3320	26620		2980

[1] 1984 data from U.S. Fish and Wildlife surveys

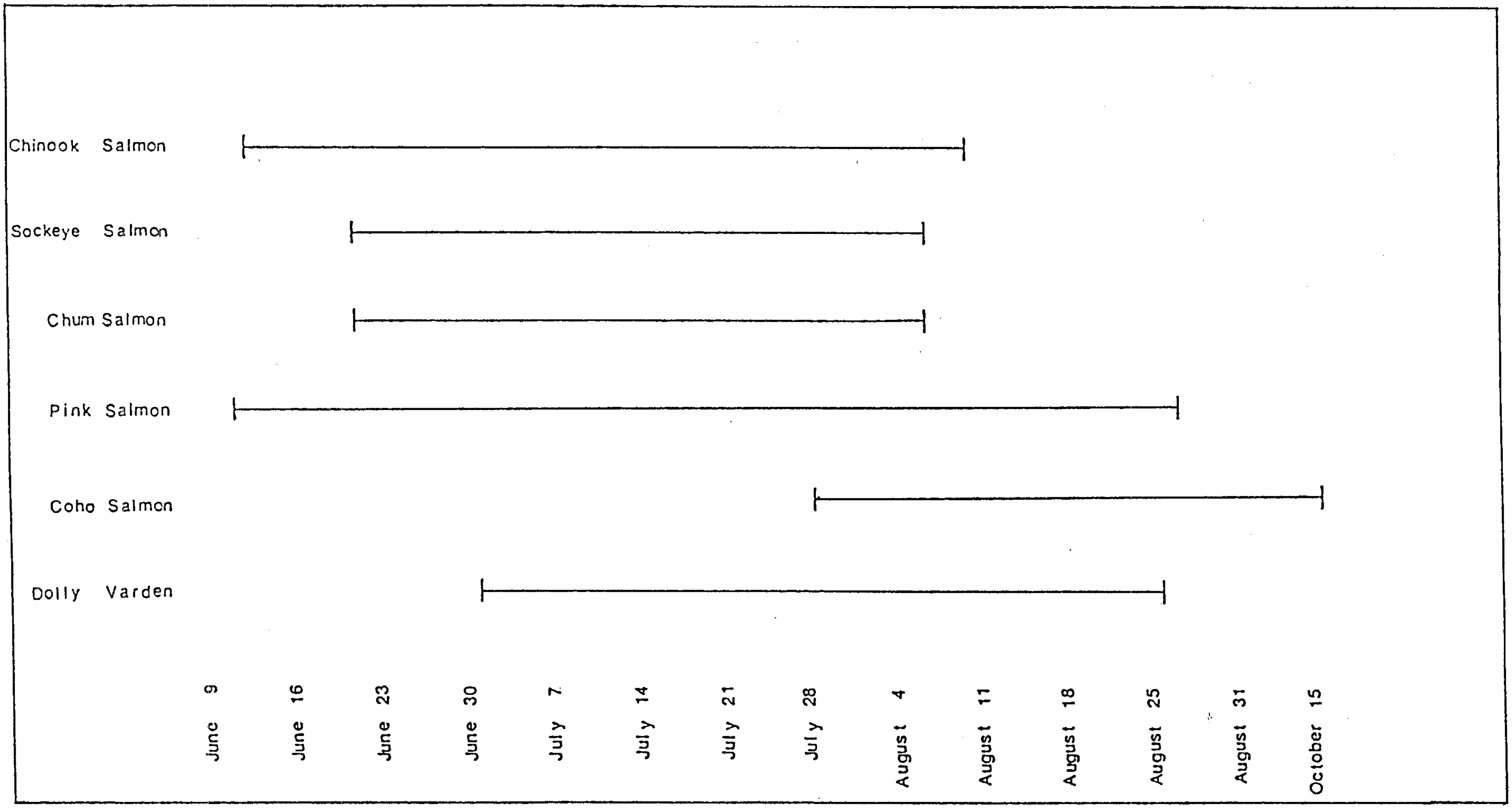


Figure 17.-Seasonal presence of adult salmonids in the Meshik River basin during 1984, as determined by hook and line sampling and aerial surveys.

Table 6.-Sex, age, and mean fork length (mm) statistics of chinook salmon sampled from the Meshik River, Alaska, 12 June - 12 July, 1984.

	Age group					
	1.1	1.2	1.3	1.4	1.5	Total
Males						
$\overline{X}$	392	481	732	812	-	650
N	5	4	7	10	0	26
SE	19	40	16	20	-	11
Females						
$\overline{X}$	437	587	699	811	848	759
N	2	3	10	23	6	44
SE	43	55	19	9	21	8
Sexes combined						
$\overline{X}$	403	526	712	812	848	717
N	7	7	17	33	6	70
SE	18	33	13	9	21	7

Table 7.-Sex, age, and mean fork length (mm) statistics of chum salmon sampled from the Meshik River, Alaska, 25 June - 12 July, 1984.

	Age Group 0.3	0.4	0.5	Total
Males				
$\bar{X}$	615	634	654	620
N	22	6	1	29
SE	5	17	-	5
Females				
$\bar{X}$	567	567	640	570
N	24	3	1	28
SE	8	11	-	7
Sexes combined				
$\bar{X}$	590	612	647	595
N	46	9	2	57
SE	5	12	0	4

Table 8.-Sex, age, and mean fork length (mm) statistics of coho salmon sampled from the Meshik River, Alaska, 28 July - 27 August, 1984.

	Age Group		
	1.1	2.1	Total
Males			
$\overline{X}$	496	566	552
N	6	23	29
SE	20	12	10
Females			
$\overline{X}$	-	586	586
N	0	19	19
SE	-	16	16
Sexes combined			
$\overline{X}$	496	575	565
N	6	42	48
SE	20	10	9

Table 9.-Sex, age, and mean fork length (mm) statistics of sockeye salmon sampled from the Meshik River, Alaska, 25 June - 12 July, 1984.

	Age Group 1.2	1.3	Total
Males			
$\bar{X}$	554	578	565
N	15	12	27
SE	4	7	4
Females			
$\bar{X}$	537	552	540
N	16	4	20
SE	4	8	3
Sexes combined			
$\bar{X}$	545	572	554
N	31	16	47
SE	3	6	3

Table 10.-Kilometers of salmon spawning and rearing habitat upstream and downstream of stream crossings within proposed oil pipeline and hard rock transportation corridors, Meshik River drainage, Alaska. Abbreviations are; SS = coho salmon, CH = chum salmon, KS = chinook salmon, RS = sockeye salmon.

Tributary name	Tributary length	Fish species present	Spawning habitat (km) upstream	Spawning habitat (km) downstream	Rearing habitat (km) upstream	Rearing habitat (km) downstream
Barabara Creek	25	CH	4	0	10	1
Bear Creek	4	CH	1	3	0	3
Birthday Creek	28	CH	10	0	15	2
Blue Violet Creek	33	SS	1	4	3	1
Braided Creek	40	KS	0	10	0	23
		SS	0	23	0	28
		RS	0	12	0	23
		CH	0	12	0	23
Cub Creek	13	CH	5	0	9	0
Landlocked Creek	40	KS	5	0	5	16
		SS	3	5	5	16
		RS	6	0	5	16
		CH	5	0	5	16
Meshik main stem	80	KS	8	0	28	40
		SS	8	0	33	40
		RS	10	0	28	40
		CH	8	0	31	40
Paddle Creek	13	CH	11	0	10	0
Plenty Bear Creek	25	KS	10	1	15	1
		SS	0	1	15	1
		RS	8	1	11	1
		CH	10	0	11	1
Rainbow Creek	15	SS	4	0	10	0
		RS	8	0	9	0
		CH	8	0	9	0

Table 10.-Continued.

Tributary name	Tributary length	Fish species present	Spawning habitat (km) upstream	Spawning habitat (km) downstream	Rearing habitat (km) upstream	Rearing habitat (km) downstream
Shoe Creek	9	SS	3	0	5	0
Unnamed tributary[a] 317-20-10700-2019	25	RS	3	5	5	11
Unnamed tributary[a] 317-20-10700-2122	6	RS	3	0	4	0
Unnamed tributary[a] 317-20-10700-2128	6	RS	3	0	3	0
Unnamed tributary[a] 272-50-10400	3	CH	0	3	0	3
		PS	0	3	0	3
Waterfall Creek	15	KS	9	0	10	0
		RS	8	0	10	0
		CH	10	0	10	0
Wolf Creek	14	SS	4	0	5	0
Total	394	SS	23	33	76	80
		CH	72	18	110	89
		KS	32	11	58	80
		PS	0	3	0	3
		RS	49	18	75	91

[a] Unnamed streams are identified using the Alaska Department of Fish and Game system of stream numbering.

Water chemistry measurements for alkalinity, conductivity, dissolved oxygen, and pH are listed in Table 11. All waters sampled were near neutral (except the outlet of Meshik Lake, pH = 8.8), low in alkalinity (< 31.3 mg/l) and generally saturated with dissolved oxygen.

DISCUSSION

Juvenile Salmonids and Resident Fishes

Tributaries probably provide rearing habitat for juvenile chinook and coho salmon as far upstream as spawning adults were observed, and this hypothesis is supported by juvenile salmonid distribution in Blue Violet Creek and Braided Creek (Figure 6). Tributaries that are not used for spawning (e.g., Rust Creek, Upthe Creek and Caribou Antler Creek) may provide rearing habitat for fish that leave other sections of the Meshik River system. These smaller tributaries may provide adequate cover and food resources for rearing and may be supplemental to the larger tributaries primarily used for spawning. Elliott and Finn (1984) documented this type of movement in tributaries of the Kenai River, Alaska. Pink and chum salmon fry typically migrate to the ocean within days of emergence (Scott and Crossman 1973; Hale 1981) and are assumed to have left the Meshik River system prior to 27 May. Juvenile Dolly Varden were sampled throughout the field season, but no pattern of movement was detected.

The reduction in catches of older (i.e., larger) coho and chinook salmon in the minnow trap as the summer progressed is attributed to fish migrating out of the system. Based on minnow trap catch data chinook salmon smolts leave the Meshik River system before the end of June (Figure 7). Few chinook salmon remain in the river system more than one winter, as indicated by low numbers of age 2 fish sampled (4 fish, < 1 percent total) and the absence of adult fish that had spent 2 years in fresh water (Table 6). Juvenile chinook salmon were most abundant in relatively fast-flowing stream channels (minnow trap sites 2 and 5), but a few fish were collected from ponds or in their outlets (minnow trap sites 1, 7, and 8).

Some age 1 and all age 2 coho salmon are thought to smolt before the end of June based on: 1) the reduced percentage of larger fish (assumed to be age 1 and 2 fish) found in the minnow trap catches after 23 June; 2) the sharp decrease in CPUE at minnow trap site 9 (Landlocked Creek) and sites 3 and 4 (Braided Creek) after 6 June; and 3) reports of similar fish movement in other Alaskan streams (Burger et al. 1983; Elliott and Finn 1984). Additional downstream migration of age 1 coho salmon appears to occur throughout the rest of July and August based on the decrease in the age 1 cohort sampled in minnow traps (Figure 8). Timing of coho salmon out-migration was difficult to determine because of the large overlap in length for age 0, 1, and 2 fish (Figure 8). Adult coho salmon returning to spawn had spent 1 or 2 years in fresh water before smolting. No preference in habitat was detected for juvenile coho salmon; fish were common in both stream channels and ponds.

Sockeye salmon movement was not determined because of the low numbers of juveniles sampled during this inventory (87 fish). Minnow trap avoidance, poor fyke net placement and smolt out-migration prior to sampling efforts are all thought to have contributed to the low sample size. Sockeye salmon are known to out-migrate from several other Alaska Peninsula river systems during April and May (Fried 1984). The length-frequency histogram of juvenile sockeyes that were sampled (Figure 9) suggests that two age classes are present in the system. However, A. Shaul (Alaska Department of Fish and Game, Commercial Fisheries Division, personal communication) found that a relationship between age and size in a river system may not exist due to differences in production among rearing habitats. The fact that all sampled adults had spent only one year in fresh water indicate that sockeye salmon smolt out at age 1. Age 1 is also the dominant fresh water age for sockeye salmon in other shallow rearing area systems in the Alaska Peninsula and Chignik management areas (A. Shaul, Alaska Department of Fish and Game, Commercial Fisheries Division, personal communication). Further investigations in the Meshik River system should emphasize increased scale collections for juvenile sockeye salmon age determination. Sockeye salmon rearing in Meshik Lake are probably progeny of Meshik Lake spawners, although juvenile fish may have moved upstream into the lake from the main stem where sockeye spawning occurred. Although no spawning was observed in Meshik Lake during this survey, lake spawning has previously been documented (Alaska Department of Fish and Game 1982) and is known to occur as late as October, even though sockeye spawning is over by August in other areas of the Meshik River drainage system (A. Shaul, Alaska Department of Fish and Game, Commercial Fisheries Division, personal communication).

Adult Salmonid Distribution and Biology

Spawning areas for adult salmonids were located primarily in Meshik River tributaries and in headwaters near Meshik Lake (Figures. 12 - 16). These areas correspond to stream sections having gravel and (or) rubble substrate.

Adult upstream movement occurred through two different channels of the Meshik River near Scotty's Island (Figure 4). Chinook salmon traveled upstream through the Lower Y channel, along the north bank of Y Lake, and back into the main stem through Upper Y channel. No chinook adults were observed in the Meshik River between Lower and Upper Y channel, although some movement must have occurred because adults were seen spawning in Landlocked Creek. The other major migration route for adult salmon was the Meshik River channel that flows past the north side of Scotty's Island. Few fish were observed in the river channel where minnow trap site 5 was located and no fish were seen at site 6. No preferred migratory route for coho or sockeye salmon was observed and chum salmon were ubiquitous.

Adult fish moved upstream past Scotty's Island in schools and were often observed holding in deeper water along the river banks before ascending exposed shallow sandbar areas. Schooling behavior was not observed at the Lower Y channel; instead, there seemed to be a continuous upstream movement of fish.

Coho salmon are known to concentrate in Landlocked Creek on the south side of Scotty's Island before the annual fall rains cause the river to rise. The fish then move up to spawning grounds in Landlocked Creek (E. King, Kings Flying Service, personal communication). Eight hundred coho salmon were counted in Landlocked Creek south of Scotty's Island during the 13 September 1984 aerial survey. Heavy rainfall began soon after this date and by 27 September 1984, the river had risen to the highest water levels observed during this inventory. No fish were seen near Scotty's Island during the 15 October 1984 aerial survey.

Large groups of fish, assumed to be anadromous Dolly Varden (i.e., large silver-colored Dolly Varden), were also seen in Landlocked Creek near Scotty's Island in August and several hundred smaller sized Dolly Varden were seen in

Landlocked Creek about 1 km upstream from Scotty's Island. These char concentrations are probably a combination of Dolly Varden following salmon upstream to spawning grounds where they feed on salmon eggs, and their own upstream spawning migration. Dolly Varden are known to occur up to Meshik Lake, but the abundance of resident and anadromous fish is unknown.

Aging of Dolly Varden scales proved unreliable due to the small size of the scales and the high frequency of regenerated scales among the samples (S. Corley, National Fisheries Research Center, personal communication). Further attempts at aging Dolly Varden should emphasize examining otoliths for age and life history information.

The Meshik River drainage is one of the major spawning areas on the refuge for chinook and coho salmon (Anonymous 1985). It also produces a small run of sockeye salmon. These fish resources support a small commercial fishery (when compared to Bristol Bay). Estimated commercial catches of Meshik River chinook for the period 1981 through 1985 averaged 6,934 fish, and for coho salmon the 5-year average is 12,239. With an average of 3,907 sockeye and 223 chum salmon, the total commercial catch average is 23,302 (Alaska Department of Fish and Game 1985). The Meshik River does not appear to be important for pink salmon production, as the 5-year average for these years is zero . Only 11 adults were observed in 1984; observers counted 50 pink salmon in the Meshik River in 1977 and 50 in 1980 (unpublished data, Alaska Department of Fish and Game, Division of Commercial Fisheries, Kodiak, Alaska). There are no known major pink salmon producing streams on the Bering Sea side of the Alaska Peninsula between Cape Krenitzin and Cape Menshikof (A. Shaul 1985, Alaska Department of Fish and Game, Commercial Fisheries Division, personal communication). Subsistance and sport fishery values have not been quantified but must also be considered when evaluating potential impacts. Village residents of Port Heiden depend on the subsistence fishery, traditionally as well as economically, and concentrated subsistence fishing effort occurs (Alaska Department of Fish and Game 1977). Most of the lower Alaska Peninsula streams receive little sport fishing effort due to inaccessability and are still largely undeveloped. The Meshik drainage supports a large population of brown bears, bald eagles and other wildlife species that depend on the fish resource.

Recommended Studies

Without further input as to types of development schemes and areas involved, the anticipated impacts of development are difficult to assess. In general, construction involving stream crossings has the potential to increase sediment loads, change the slope and channel configuration of stream beds (which in turn can flood, dewater, or block channels), and increase human presence in the area. Depending upon the duration of the disturbance, construction during critical life history phases (migration, spawning, or incubation) could adversely affect the success or survival of particular stocks. Due to the nature of the fish resources in the Meshik River (i.e. the presence of five salmon species plus anadromous char), there appear to be few time periods during the year in which construction could occur with impunity. Timing construction activities to minimize impacts is dependent on the types of habitat and utilization of these habitats by resident and anadromous fishes. Winter rearing habitats have not been described for Alaska Peninsula fish stocks but are probably limited. Spawning and incubation would be least disturbed in early spring between alevin emergence and chinook salmon spawning migrations.

Recommended studies for the Meshik River drainage basin are: 1) studies of habitat utilization by juvenile anadromous salmonids, including movement dynamics and food and cover resources used; 2) more studies of population dynamics and migration timing of juvenile salmonids; 3) continue to quantify adult salmonid spawning areas; 4) continue with baseline physical and hydrological studies for streams crossed by the corridor.

Quantitative information about the relative value of different aquatic habitat types to fish species present in the Meshik River will result from these studies. This information is needed to assess the effects of developing corridors and to insure that fish resources are protected.

ACKNOWLEDGEMENTS

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Appendix A.-Meristic characteristics of Dolly Varden sampled from the Meshik River, Alaska, 1984.

	Adult			Juvenile		
Sex	Mid-eye to fork length (mm)	Number of gill rakers upper-lower	Number of pyloric caecae	Fork length (mm)	Number of gill rakers upper-lower	Number of pyloric Caecae
M	600	9-12	29	125	8-13	30
M	508	10-12	24	118	9-12	24
F	514	8-10	27	110	7-10	24
F	514	8-12	25	109	9-10	32
M	502	9-11	29	94	9-11	26
F	486	9-13	29	82	9-10	25
F	474	9-12	24	79	7-10	23
F	457	9-13	25	74	8-12	25
M	440	8-13	29	71	8-12	24
F	415	9-11	27	66	8-13	26
F	386	9-12	29	65	8-12	26
F	385	9-13	21	64	8-13	27
M	368	10-12	-	62	9-11	25
M	311	9-12	-	57	7-12	26
				56	8-12	22